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Fig. 1.—Service-Bus Installation Run in Iron Conduit on Building Fronts.

Overhead and Underground Service Installations

Review of Present Practice in Making Customers' Service Installation Particularly with the Idea of Relieving the Streets, as Far as Practicable, of Overhead Wires

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ONE of the problems which is today confronting the central-station company is that of relieving the streets and highways of the unsightly appearance of overhead wires. It must not be inferred that the only remedy for this condition is a change to underground construction, for if proper attention is paid to neatness of construction of the overhead distribution system a great improvement may often be effected in the general appearance of the outside plant.

Until recently the matter of installing consumers' services has been given too little attention. In the early days of line construction practically no thought was given to the importance of the service installation. This was left more or less to the individual judgment

of the lineman, who usually considered it sufficient if the actual connection was made and the customer's equipment placed in service, regardless of appearance or safety. This haphazard work frequently resulted in interruptions to service and unsatisfactory relations with the customer.

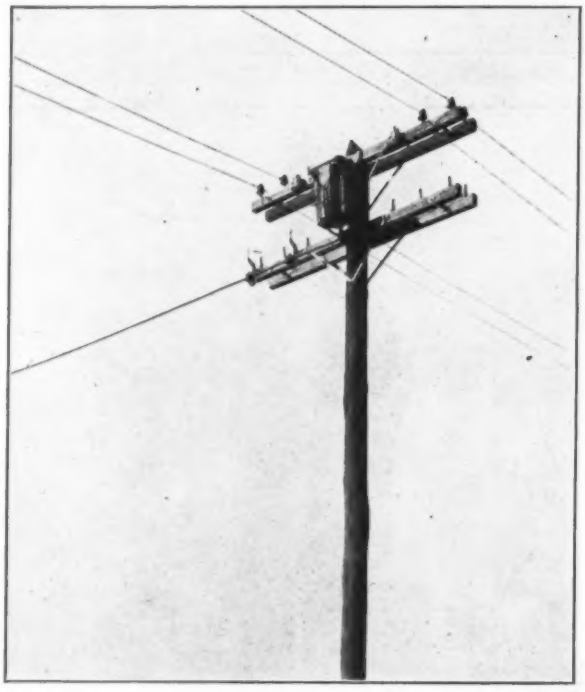


Fig. 2.—Use of Spreader Brackets with Service Cable.

In this and two succeeding articles, the matter of overhead and underground construction, as it applies to the consumers' services, will be discussed, particularly as regards the present practice of the larger central-station companies.

The method of providing for service extensions varies widely in different sections of the country. In thickly populated or growing districts, where it is not likely that such extensions will prove unprofitable, the line is usually run without cost to the customer. In sparsely settled districts, where considerable time must elapse before a return is secured on the investment, or where the length of the extension is such as to require the setting of poles on the consumer's property, most utility companies bill the customer with the actual cost of the work. When it is found that due to additions of load the extension becomes profitable, it is fair that the customer should at least be partly reimbursed. The method of making refunds varies, but it may take either the form of a yearly discount on the customer's bills or a rebate at the time of taking on each additional customer. Where there are no definite rules governing the length of a service connection to be run without cost to the customer, and the amount of charge to be made for an excessive service run has not been fixed, customers may not in all cases be charged on a uniform basis.

The following rules and regulations have been adopted by a large utility company in order to standardize this matter through its territory.

Service Definitions of a Large Central Station.

Overhead Service Connections.

By "Service" is meant that part of the overhead system from the last pole of the main line to consumers' outlets. Main lines are variously located, but these locations may be classified as follows:

(a) On public highways.
(b) On private highways considered public.
(c) On private property when used or intended for common distribution, such as on rear property lines in the interior of blocks and like locations.

Underground Service Connections.

By "Service" is meant that part of the underground system, from manhole or service box at curb, to cutout switch in consumer's building.

Rules for Lighting Installations.

Overhead Distribution.

1. A service connection which does not require a pole placed on private property to make the run shall be made without cost to customer. (A pole set on curb line of street or public highway to bring wires across the street shall not be counted.)

Where service connection is of that length or character requiring one or more poles placed on private property to make the run, the excess run shall be paid for by customer at the rate of $12 per pole for each such pole set.

2. A customer desiring underground service connection in overhead section must run wire in conduit at his expense from building to pole.

3. Primary service connection to transformer located in vault on premises of the customer in overhead sections will be run underground, the cost to be paid by the customer, the same as for secondary underground services in overhead sections. The customer is to furnish and install the necessary conduits. The company, however, will provide the primary cable from the main line to transformer, but the cost of the cable and installation thereof will be billed to the customer.

4. Where it is necessary, purely from the company operating standpoint, to furnish primary service connection in overhead section to transformer in vault located on the premises of customer and to install

Fig. 3.—Combined Overhead and Underground Service Connection.

such service underground, the company will furnish and install the necessary cable and conduit from the main line to the transformer at its expense, provided the distance is not in excess of 125 feet from the curb. Where the distance exceeds 125 feet the company will complete the installation but the customer will be billed

at cost for that part of the service connection in excess of 125 feet.

Before this rule shall be operative in any case, however, superintendents will be required to make a recommendation containing the reasons for making such recommendation, and obtain the approval in writing of the proper operating official.

Underground Distribution.

5. A service connection not exceeding 30 feet in length from the curb shall be made without cost to customer. Excess is to be paid for by the customer at the rate of 50 cents per foot.

6. Primary service connections to transformers located in vaults on premises of customers shall be subject to the same rule as for secondary underground service.

Rules for Power Installations.

Overhead Distribution.

7. Service connections for power installations (other than those for residences) will be furnished without cost to the customer as follows:

Installations up to and including 10 horsepower of connected capacity, a run not more than one pole on private property.

For each additional 20 horsepower or fraction thereof of connected capacity, one additional pole of service run. (A pole set on curb line of street or public highway to bring wires across the street shall not be counted.)

Where service connection is of a length or character requiring a larger number of poles placed on private property than called for above, the excess service run shall be paid for by the customer at the rate of $12 per pole for each excess pole set.

Where power service is furnished to a residence it is usually furnished from single-phase mains and from the service connection which supplies the lighting. Where a separate service connection is supplied for power service the same rule as that for a lighting-service connection shall be applied.

8. Primary service connection to transformer located in vault or to apparatus on premises of customer in overhead section shall be run underground under the same conditions as set forth in rules Nos. 3 and 4.

Underground Distribution.

9. Service connections for power installations (other than those for residence) will be furnished without cost to the customer as follows:

A run of 50 feet from the curb plus 1 additional foot for each horsepower of connected capacity.

Excess to be paid for by the customer at the rate of 50 cents per foot.

10. Primary service connection to transformers located in vault or to apparatus on premises of customer will be subjected to the same rule as No. 9.

11. Where primary service is furnished to a customer or where primary service connection enters the premises of a customer for either lighting or power service, the primary oil switches, primary disconnecting switches and primary fuse blocks, which are necessary from the company operating standpoint, will be furnished without cost to the customer.

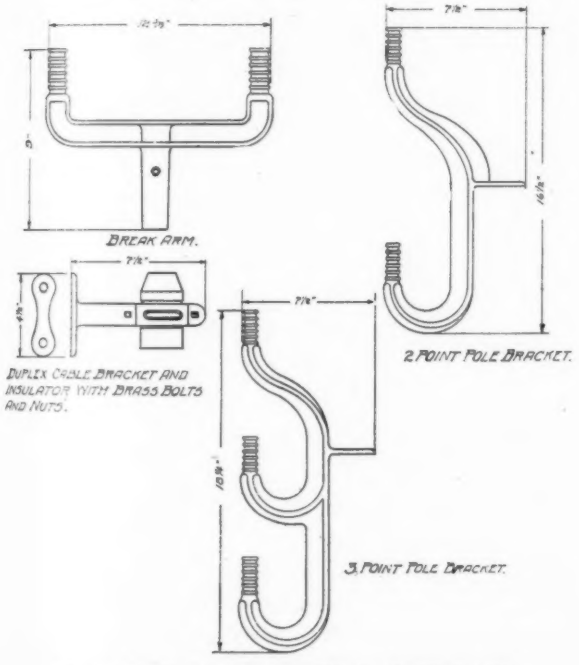


Fig. 4.—Types of Pole Brackets in Common Use.

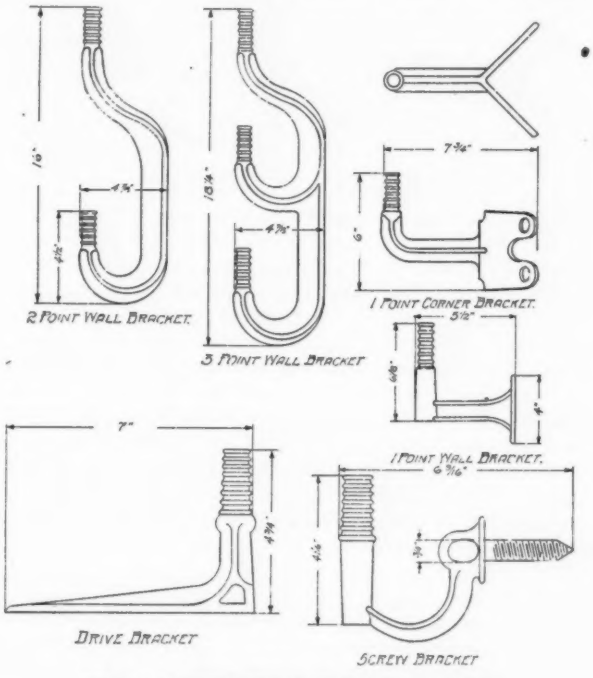


Fig. 5.—Common Types of House Brackets.

Overhead Services.

A method frequently employed has been to install individual service wires into each building. Very often this connection consisted merely of a tap made directly to the line wires, no particular attention being paid to the matter of having the service wires straight or neatly arranged. Brackets and outlets of unsightly appearance were placed on building fronts with the result that customers frequently objected to the defacing of buildings.

The use of individual wires for service connections has of late been superseded to a large extent by duplex and triplex service cable. This makes a better looking installation and also minimizes the number and in many cases the size of building attachments. Its use, however, should be limited to loops not exceeding 100 feet in length, and such cable should not be used in

sizes of wire larger than No. 4, unless the service loops are very short. Service cable is fastened at the pole by means of a bracket, several forms of which are in common use. Loops are made to the main back of the strain and the cable stretched to a convenient point of suspension on the building. This form of installation makes a very neat appearance as is shown in Fig. 2, and is a considerable improvement over the older type known as the "buck" or reverse-arm construction.

The usual type of service cable consists of two conductors each insulated with a rubber compound, and covered with a weatherproof braid; the conductors are laid together parallel with weatherproof braid over all. In preparing specifications for this class of cable it is well to provide for the usual clauses covering rubber insulating compound and cotton-braid covering. The surface of the cable should present a smooth, hard and even finish and be thoroughly slicked down. The weatherproof compound should contain no substance which will subject the insulation to deterioration, and should not drip at 160 degree Fahrenheit, nor lose its elasticity at zero Fahrenheit.

In residential districts where the owners of houses object to both the open wire and service cable which require building attachments, the use of underground service connections will be found effective. The cost of this form of construction is usually borne by the customer.

In Fig. 3 is shown a vertical run of service cable from the transformer secondary connecting to the service wires of the consumer, installed in an underground lateral pipe. This figure also illustrates an overhead cable service run from the same pole and carried on brackets to the service pipe.

Where the installation of individual wires is necessary, pole brackets of the spreader type are commonly used. The wires are carried across the pole to the end of the arm, sufficient clearance being allowed so that the service wires will clear all the other wires on the pole. The wires from the pole bracket to the point of attachment on the building should be in as direct a line as possible, making the run as nearly as practicable in a horizontal direction.

Brackets and Other Fittings for Service Loops.

Service wires may be suspended from crossarms and buildings by the use of various types of pole and house brackets such as illustrated in Figs. 4 and 5.

Fig. 6.—Installation of Service Cables.

Different brackets are designed to suit the various conditions encountered in attaching wires and the proper brackets for each case in hand should always be used.

There is opportunity for the display of considerable ingenuity in selecting the simplest, neatest and most secure location for the type of bracket to be used in making the many different styles of service connections encountered. The same type bracket should, when possible, be used to support two or more adjacent parallel wires and the brackets should be so located that the insulators will always stand vertical.

In residential districts where there are detached houses, the erection of secondary mains on vertical pole brackets will in certain cases be found advantageous. Their use permits of neat, substantial construction at a moderate cost.

There are many types of fixtures on the market all of which are more or less satisfactory, but unless some attempt is made to standardize, there is a tendency to overstock distribution storerooms with a large number of fixtures, many of which are special. Where companies are using an unreasonable number of types of fittings, study should be given to the matter of standardization.

Recently an investigation by one large company revealed the fact that numerous different types of fittings were being used on overhead distribution work. After a careful study of the situation it was found that many of the fittings in use could be eliminated with the result that eleven standard fittings were finally selected to cover the entire field of distribution work. This standardization resulted not only in a reduction in the amount of material carried in stores, but also in a more uniform and satisfactory form of construction.

Reducing the Cost of Service Connections.

In many of the suburban sections of our cities the expense of making a service connection is out of proportion to the revenue received from the customer, and in order to cut down this expense some companies have resorted to the use of twisted-pair service wires as a substitute for service cable. The twisted-pair service wire has the advantage over two or three separate conductors for two and three-wire service as regards appearance, convenience and cost of installation. In making up twisted double or triple wire for service connections, stranded copper wire with weatherproof insulation having a triple braiding heavily waxed is used. No over-all braiding is recommended, as it has been found in some cases after a short period of service that the outer braid held the water and caused short circuits. In sections of the country where houses are some distance apart and the loads are light, resulting in a small yearly revenue, twisted-wire services demand favorable consideration. Where such wire is applicable to service work it has all the advantages of service cable as regards appearance and convenience, and in addition is somewhat lower in cost.

The matter of reducing the size of service wire is a very important item, particularly on account of the present high price of copper. With most of the larger companies the smallest size service wire is usually No. 6. Among the smaller companies considerable saving may be effected in the service installation costs by reducing the size of service wires to No. 8, on all installations where the limiting factor is mechanical strength. The use of No. 8 wire for most small installations will result in no serious trouble from excessive voltage drop and its substitution in many cases may effect a sufficient saving in first cost to insure a profitable return on the investment. The conditions back of each case will govern the type of construction, but security and continuity of service should not be sacrificed for

cheapness even in the smallest central-station distributing plants.

In Fig. 6 is shown a street where a number of taps, consisting of service cable, are run to the individual houses. While this form of installation is a marked improvement over some of the older forms, it still has its disadvantages in that a large number of service connections are required for each block of houses served.

Service Buses in Conduit.

In many localities the number of wires along the street has been considerably reduced by running buses along the fronts of buildings from which the customers are fed by means of subservices. These buses may be run in open wire or conduit under the eaves of the house tops or, where this is not possible, the buses may be run in conduit along the face of the building, either above or under the porches, as shown in Fig. 1. The location of the service bus depends largely on the type of building construction and under certain conditions where the houses are detached may not be practicable. In business sections the matter of service bus installations becomes quite simple as where the wires are installed in conduit it can be entirely hidden from view by mounting the conduit directly above the cornice of the store windows.

Where conduit is run over the store fronts, it is customary to paint it the same color as the building, and this makes it inconspicuous and further tends to improve its appearance, with the result that the finished work is very satisfactory. In such cases two service supply wires may feed one entire block, one being connected to each of the end buildings. In Fig. 7 is shown an installation as just described and attention is called to the general improvement of the appearance of the street as compared with a street on which individual services are installed for each customer.

Installations such as shown in Fig. 7 should certainly have a great moral effect on civic and municipal bodies in curbing dissatisfaction which might otherwise result in the compulsory installation of a more expensive underground system of distribution.

Central-station companies recently have been confronted with new problems due to the rapid growth in

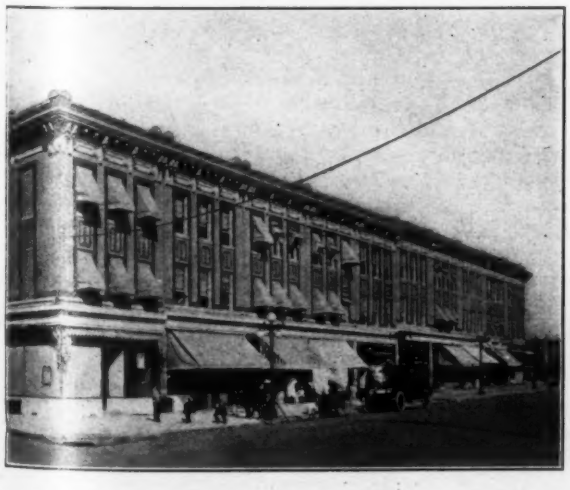


Fig. 7.—Service-Bus Installation Over Store Fronts. Feed from Each Corner of Building.

commercial load, particularly where large power service is required for the operation of industrial plants.

The tendency has been to supply such customers with high voltage or primary service, which has necessitated in many cases the reconstruction of existing lines.

Use of Aerial Cable Supported by Messenger Wire.

One of the special methods of solving this problem has been by the use of aerial cable run on poles and supported by messenger wire, a form of construction similar to that used in telephone work.

In Fig. 8 is illustrated an installation of aerial cable which consists of three No. 00 copper conductors in-

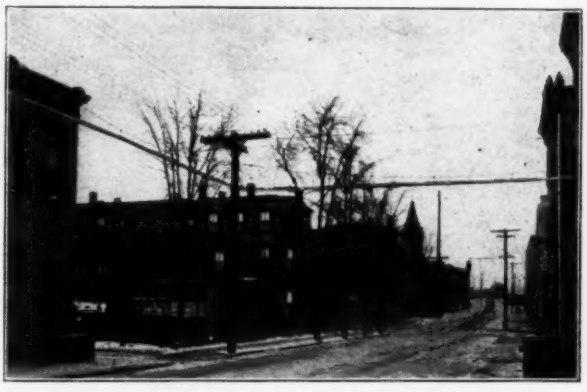


Fig. 8.—Installation of Aerial Light and Power Cable.

sulated for operating at 13,200 volts. The cable for this class of service is of special construction and consists of paper insulation over the individual conductors, a paper jacket and a reinforced rubber outer covering, the outer cover being similar in construction to that of the ordinary garden hose.

The entire cable is covered with tape well saturated with rubber compound and a weatherproof braid thoroughly impregnated with waterproofing compound.

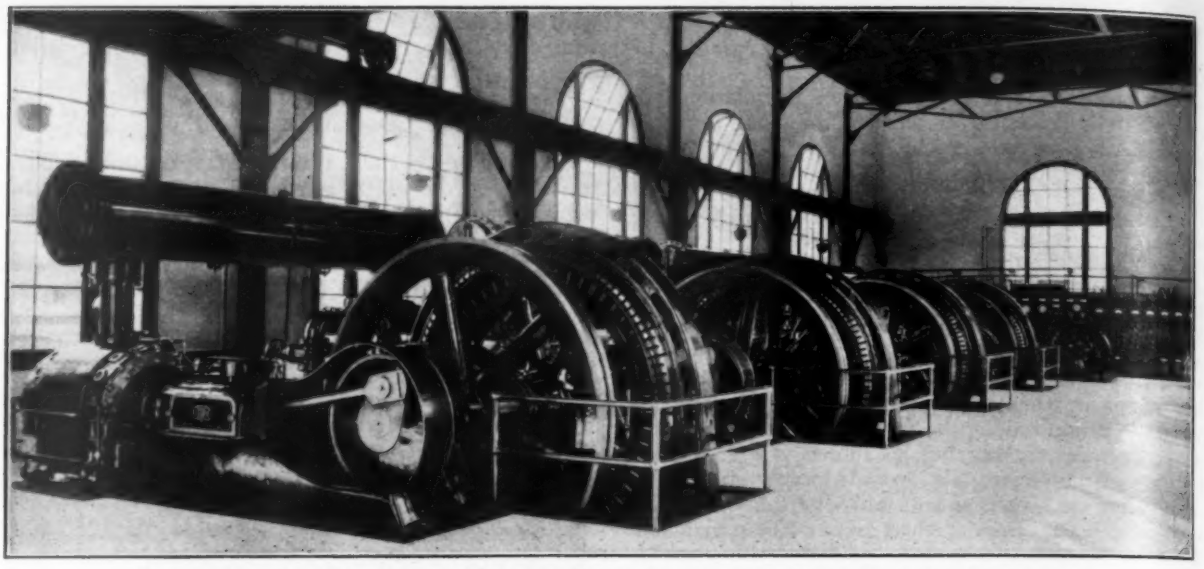
For mechanical protection the finished cable is encased in an armor made up of galvanized steel tape.

The cost of this cable is somewhat higher than open-wire construction, but it has the advantage that it may be used for high voltage where the installation of open wire would be out of the question, and the cost of underground construction prohibitive.

Technical Men Needed in Army.

In connection with or in response to the call of the President for volunteers, the attention of all technical men, men skilled in any line of mechanical, electrical and chemical science, or knowledge of ordnance, explosives, mining, ship building, railroads, motors, metallurgy, building of aeroplanes, water supply, and sanitation, is especially invited to the needs of the army for such young men—aged 18 to 40—in sundry branches of technical troops. Concerning this matter please write for literature to Major J. E. Bloom, U. S. A., 266 Market Street, Newark, N. J.

Any technical men who are exempt or who from any cause cannot volunteer, can yet efficiently cooperate, by forming technical patriotic educational guilds in their several industries or home neighborhoods, especially to look after the welfare of their men in the service, and to give them the opportunity of obtaining technical assistance, opinions and advice from home, in any war industry, from time to time.



Four Synchronous-Motor-Driven Air Compressors in One of the Plants of the Union Iron Works.

Lubrication of Motor-Driven Air Compressors

Importance of Proper Lubrication in Order to Reduce Troubles—Requirements of Suitable Oil—Economy in Use of Oils—Causes of Compressor Explosions

THE subject of air-compressor lubrication, as applied to both electrically and steam-driven machines, is an important one because of the troubles commonly met from improper lubrication of these extensively used machines. This subject is exhaustively covered in an illuminating treatise prepared by the Lubrication Engineers' Association of The Texas Company, New York City. Embodied in this compilation are many facts relative to air compressors generally, their mechanism, the air temperatures attained under various stages of compression, and other details of air-compressor practice. Properties of various lubricants, and their adaptability in compressor operations are set forth in a manner particularly interesting and valuable to operators of electric power plants. These facts may be summarized as follows:

In general, air compressors may be divided into two classes: the single-cylinder, single-stage type, and the multi-stage type. In the single-stage type, the air is compressed to the full desired degree of compression in one cylinder and in one operation, while in the multi-stage type the desired compression is reached by two or more stages. The single-stage compressor is the one in most common use, particularly where small air supplies are required, and generally operates under a pressure of from 50 to 60 pounds per square inch.

Development of Heat in the Compressor.

The compression of air results in the conversion of the energy used into heat. The rise of temperature of a volume of air under compression follows certain laws, and tables have been compiled which show the theoretical temperatures the air will attain when compressed to certain pressures. The following table gives the temperature that air will attain, taking the inlet at 60 degrees Fahrenheit.

Gauge pressure.	Atmospheres.	Final. temperature.
0 lbs.	1.	60 Deg. F.
25 lbs.	2.7	234 Deg. F.
50 lbs.	4.4	339 Deg. F.
75 lbs.	6.1	420 Deg. F.
100 lbs.	7.8	485 Deg. F.
125 lbs.	9.5	540 Deg. F.
150 lbs.	11.2	589 Deg. F.
200 lbs.	14.6	672 Deg. F.

In actual practice, however, the temperatures never reach these figures, for the reason that in the economical operation of compressors it is important that the temperatures be kept as low as possible. For this reason the compressor cylinders and cylinder heads are provided with jackets through which cold water is circulated to absorb as much of the heat of compression as possible. If the water jackets are of insufficient capacity, or if too small an amount of water is circulated through them, trouble is likely to occur. A large percentage of the trouble experienced with air compressors is on single-stage compressors. Examinations have shown that in many instances this is due to the fact that they are overloaded from being forced beyond their capacity, excessive heat being generated thereby.

Where the air is compressed through more than one cylinder, the temperature of the air is still further reduced by passing it through intercoolers on its way from one cylinder to another. These intercoolers connect the air discharge of the first cylinder with the suction or inlet of the second cylinder, and, in case the

air is compressed successively through three or four cylinders, intercoolers are placed between each two cylinders. These intercoolers contain a number of small tubes through which the air passes and over which the cooling water circulates. In this way the air, even when compressed to 800 or 1000 pounds per square inch, will, after passing from the last cylinder, be comparatively cool. In fact, the final discharge from a multiple-cylinder compressor is often cooler than from a single cylinder, compressing to only 80 or 100 pounds pressure, especially where the single-stage machine is driven at high speed.

The water side of intercoolers and water jackets should be kept free from all dirt, mud and other foreign matter, which the cooling water is apt to bring with it. This foreign substance can be detected by watching the discharge from the jackets or coolers. The failure to observe this precaution has in some cases been responsible for air-compressor explosions, as jackets and coolers become very inefficient if they are coated with mud or scale. This trouble with multi-stage machines is not usual, as the intercoolers, if properly cared for, never allow the air temperature to become excessive.

External Lubrication of Compressors.

The external lubrication of air compressors does not differ from ordinary lubrication. In the case of steam-driven compressors the main bearings, crank pins, and crosshead guides are usually lubricated by a splash system. The crank case of the frame is filled with oil to a sufficient height to permit the partial submergence of the crank disks, and when in operation the oil is carried to or splashed over the various parts to be lubricated. After passing through the bearings, the oil is returned to the crank case and is used over and over. In some cases the crank pins are fitted with pendulum oilers with stationary cups, and the other bearings are fitted with sight-feed oil cups.

In design and construction the air compressor of the ordinary or piston type is similar to a steam engine. The action, however, is the reverse of the steam engine, for in the case of the air-compressor cylinder, power is transmitted to the piston through the shaft and connecting rod, instead of from it. In a simple form of compressor, the air in front of the piston is compressed until the pressure reaches a point sufficient to open the discharge valve, and the charge is then forced into the receiver through the outlet pipe. In the meantime a partial vacuum has been formed in the cylinder back of the piston which has caused the inlet valve to open, admitting air at atmospheric pressure, so that at the end of the stroke the cylinder is filled with free air for compression upon the return of the piston. The action of both the inlet and outlet valves is entirely automatic, the former opening inward and the latter outward when the pressure on the two sides become unequal.

Internal Lubrication of the Compressor Cylinder.

So far as internal lubrication is concerned, the problems offered by the steam engine and the air-compressor cylinder are entirely different. In the steam engine, moisture, which has a tendency to wash the oil from the surfaces of the cylinder and valves, is always present to a greater or less degree, requiring in most cases the use of a compounded oil. In air-compressor cylinders, on the other hand, the surfaces are dry, and so compounded oils are never used. Moreover, less oil is required for the air-compressor cylinders, since the oil is not washed off the cylinder walls.

As in case of steam-cylinder lubrication, the conditions of the internal surfaces, the piston speed, and the weight and fit of the piston must be taken into consideration in selecting the proper air-compressor oil. Low speeds and heavy or loose-fitting pistons require a higher viscosity oil than high speeds and light or tight-fitting pistons. Other important factors which govern the lubrication of air compressors are the degree to which the air is to be compressed, the location of the air inlet, the method of applying the lubricants, the kind of valves used, and the size and kind of water jackets and intercoolers.

In the horizontal air compressor, as in the horizontal steam engine, the entire weight of the compressor piston must be sustained by the lower portion of the compressor cylinder. With this type of compressor it is, therefore, necessary to use a lubricant of sufficient body under the heat of compression to prevent metal contact, and to reduce wear to a minimum. Vertical compressors do not require as much lubricant or as heavy a lubricant as horizontal ones.

Requirements of Compressor Oil.

One of the most important requirements of an air-compressor oil is that it should have a viscosity sufficiently high to meet service requirements. For high pressures and temperatures an extra heavy viscosity oil should be used. For medium pressures and temperatures a heavy viscosity oil, and for low pressures and temperatures a medium viscosity or one of light viscosity should be used. The oil should have sufficient body to sustain the weight of the moving parts, to form a seal between the piston rings and the cylinder walls, and to prevent the excessive use of oil. On the other hand, the viscosity should not be too high to obtain efficient atomization or to cause excessive friction. Moreover, if an oil of too great viscosity is used, it will tend to collect any dust that may be in the air and will tend to bake on the hot surfaces and form carbon deposits. This is especially likely to happen when more oil has been used than is just sufficient to lubricate the wearing surfaces.

Another requirement of air-compressor oil is that it should not be decomposed under the heat conditions to which it is subjected in the air-compressor cylinder, resulting in the formation of carbon. The chief objection to steam-cylinder stocks is that they easily decompose under air-compressor cylinder conditions, forming sticky and hard carbon deposits in the cylinders and valves or air lines. Carbon deposits are probably the chief cause of air-compressor explosions. They also hinder the working of the valves and by increasing the friction cause an increase in the temperature of the air. Carbon also has a tendency to cause bad cutting of the valves and valve seats which can result in a considerable amount of damage in a short time. The amount of carbon formed with certain grades of heavy, medium and light oils is small, due to the fact that they do not readily decompose; and any deposit which is formed is of a dry, sooty nature which does not collect dust nor accumulate in the cylinder or on the valves.

An extremely high flash test has been greatly overemphasized as a qualification for air-compressor oils. Even though the temperature of compression should reach the flash point of the oil an explosion would not take place, as the flash point is considerably increased by the high pressure and as a spark or flame must be

introduced before the oil would flash. If carbon deposit is present, which is rendered incandescent by the increased heat of compression, an explosion may occur irrespective of the flash of the oil. The oil would have to be submitted to a temperature much higher than its flash point before combustion would take place without the introduction of a spark or flame. A good example of combustion without the introduction of a flame is that of the Diesel engine, which is discussed below, and in which the temperature is as high as 1000 degrees Fahrenheit.

One of the troubles commonly met with in compressors is the groaning of the pistons. Generally this can be traced to an improper fitting of the piston rings, which, being subjected to alternating pressure, set up a vibration which allows the air under compression to leak by the piston rings in an unsteady flow. This in turn, increases the vibration of the rings and results in the groaning of the pistons. This condition exists in compressors that have been in use for a considerable time without renewal of rings, and it can frequently be overcome by using a higher viscosity oil.

Introducing the Oil Into the Cylinder.

In steam-cylinder lubrication it is necessary that the oil be atomized or broken up into small particles so that it will be carried by the steam to the surfaces to be lubricated, as well as to the exhaust valves. The same is true, to a certain extent, in air-compressor lubrication, in which case the oil should be atomized by the incoming air, and carried to the surfaces of the cylinder walls and to the exhaust valves. As in the case of steam-cylinder lubrication, the atomization becomes more complete with an increase in distance between the point of introduction of the oil and the valve chest.

Ordinarily, the oil is introduced into the air compressor at or above the point of air intake. Where large-diameter cylinders are used, particularly in the type known as the blowing engine, a different method of introduction is required. This method consists of introducing oil at different points of the cylinder, preferably at the top, and also at the side center of the cylinder. The oil is spread over the entire length of the cylinder by the wiping effect of the piston as it travels back over the cylinder.

The greatest efficiency is obtained by the use of automatic lubricators, and many types of compressors are now equipped with these lubricators. In many cases of steam-driven compressors two-compartment lubricators are used for feeding two kinds of oil, one to the steam cylinders and the other to the air-compressor cylinders. These lubricators insure a uniform rate of feed irrespective of any changes in the air pressure.

Troubles Due to Excess Oil.

It is impossible to make any hard and fast rule as to the proper amount of oil to use in a compressor. Trouble experienced with air compressors is probably more frequently due to the use of an excessive amount of oil than to any other cause. The amount of oil necessary to lubricate an air cylinder is usually about one-third to one-fourth the quantity required to lubricate a steam cylinder of the same size. If the lubricant is unsuitable, an excessive amount is required to keep the cylinders from groaning, and the result of the use of an excessive amount of oil is carbonization in the air passages, and particularly on the discharge valves. Sticking of these valves, allowing hot compressed air to flow back into the compressor cylinder, is a sign of too much oil. The discharge valves should be examined regularly, and the receiver and discharge pipes blown out. This will effectually remove all oil, water and sediment, which may have accumulated. The trouble sometimes experienced in the lubrication of the high-pressure cylinder of a three-stage compressor can usually be attributed to excessive amounts of oil.

In one plant equipped with a small single-stage machine compressing air to 90 pounds pressure, over a gallon of oil a day was being used and there was continually carbon trouble, while in another plant equipped with the same make and type of compressor, performing the same duty, only a pint of oil was used per day, and no carbon trouble was experienced. In the first case the large quantity of oil accumulated around the discharge valves and passages, and being exposed to the heat of the compressed air, would bake on, layer after layer, and unless cleaned out frequently would completely stop up the air passages. In the second instance the amount of oil used was sufficient to lubricate the wearing surfaces, yet not enough to accumulate and form carbon or coke deposit.

Another cause of complaint has been found to be due to the use of unsuitable oils, such as compounded steam-cylinder oil, in the air compressor. These oils, besides being very viscid, contain much free carbon matter, which clings to the orifices of the discharge valves and seats, gathering dirt from the air. Under the influence of the dry heat together with the dirt from the air, these oils soon become carbonized and form a hard flinty substance that requires considerable labor for its removal, while the animal oil used in compounding separates and forms a sticky residue which under the dry heat conditions decomposes, liberating a free fatty acid. This will honeycomb or etch the cylinder and piston surfaces and also make the piston rings more brittle.

Simple Test of Oil for Compressor Lubrication.

One of the engineers reports a series of tests which he conducted to determine the effect that heat would have on various lubricating oils when subjected to high temperatures such as exist in an air-compressor cylinder. As he says, the best way would be to test the oils in the cylinders of an air compressor, but as in most types of compressors the valves are in one large heavy casting, which, with the water pipe connections, make them difficult to remove, not many engineers care to go to the bother of doing it.

He then devised a plan whereby he could determine approximately the action of different oils under heat conditions somewhat similar to those which exist in an air-compressor cylinder. This was accomplished by taking a block of cast iron about 6 or 8 inches square and 2 inches thick and placing it on a layer of dry sand in a shallow iron pan, packing the sand close around the cast-iron block, and placing the pan over a gas burner. The upper surface of the block was polished and a hole about ½ inch deep drilled in it, large enough to hold the mercury bulb of a thermometer, cylinder oil being poured into the hole so as to make a close heat contact.

Air, taken at a temperature of 60 degrees Fahrenheit and compressed to 125 pounds per square inch gauge pressure, will theoretically attain a temperature of 540 degrees Fahrenheit, but in actual practice, owing to the water flowing through the heads and around the cylinders, the temperature of the discharge air seldom, if ever, goes above 400 degrees in a single-

cylinder compressor, so the block was heated to this temperature.

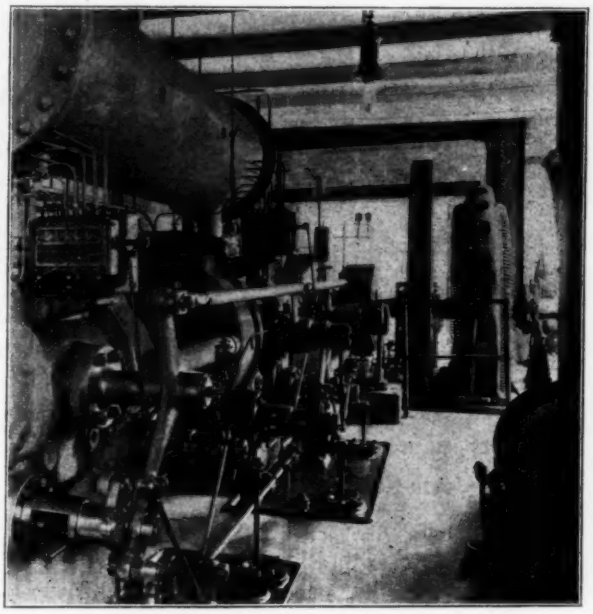
When the thermometer showed 400 degrees Fahrenheit a certain oil was taken that had been used at one compressor plant. This was a very light bodied, paraffin-base oil, about like a spindle or ice-machine oil. A drop of this oil was allowed to fall from the point of a lead pencil from a height of 2 inches onto the block. In 10 seconds it had spread out to a circle of 1⅛ inches, smoked slightly, and dried up almost instantly, thus indicating that it was a very poor compressor lubricant. Then a drop of a slightly heavier oil, such as would be suitable for use in turbine and motor bearings, was tried. This spread out quickly to a diameter of 1½ inches, smoked slightly and dried up in two minutes. It was but little better than the first oil. A still more viscid oil, about like a medium-bodied engine and machine oil, was then dropped on the hot surface. It spread out slowly to a diameter of 1¼ inches, smoked slightly, and the surface was oily after five minutes. In the meantime the temperature, as shown by the thermometer, had gone up to 420 degrees Fahrenheit. A still heavier oil, such as is usually used in gas engines, did still better, even after the temperature had gone up to 450 degrees Fahrenheit. It smoked but little, and a good trace of oil was still on the block after 10 minutes. A steam-cylinder oil was then tried. It did not smoke or dry up, but after a while it became thick and gummy. Even at the highest temperatures the engine oils burned up clean, leaving no trace of dry coke or carbon matter, which tends to confirm the theory that the hard formation often found in and around the discharge valves of air compressors is due largely to the presence of dirt in the air which adheres to the oily surfaces and which, under the continuous dry heat, becomes baked and burnt on.

The deductions that may be drawn from these crude tests are that for such temperatures as would be encountered in a single-stage compressor, compressing to 125 pounds, a high-grade filtered mineral oil of moderately high vaporizing point, suitable viscosity, and especially low in carbon content, will give best and most economical results. If such an oil is used in moderate amounts, if the cooling water is sufficient, if the water jackets of the cylinders and heads do not become choked with mud and sediment, and if the air inlet is properly located, no trouble will be experienced with lubrication.

The location of the air inlet on an air compressor is of great importance, and extra care should be used in placing it. It is surprising what a large amount of abrasive material can be passed through a compressor without the cylinder walls or valves being scored. Troublesome conditions usually develop from a continuous circulation of abrasive matter in the air in the valve passages, where it accumulates with oil which adheres to the surface of the valves, and eventually becomes carbonized from continuous subjection to the temperatures caused by the compression of the air. At one plant where trouble was experienced with carbon deposit, the compressor took its air from just outside the engine room and close to a dirt road. In dry weather clouds of dust were thrown up by passing teams, and the dust was sucked into the compressor. Changing the inlet so as to take air from above the roof remedied this trouble.

Lubricating Air Compressors for Diesel Engines.

The lubrication of the air compressor constitutes an important part of Diesel-engine lubrication. In the Diesel engine the bases of combustion are exhausted after the power stroke and the cylinders filled with fresh air which is compressed by the piston on the up or out stroke. Instead of the fuel entering as vapor and being ignited by means of an electric spark, as in the case of the ordinary internal-combustion engine, the fuel oil is forced into the cylinders by means of compressed air. The air that has been taken into the combustion cylinders is compressed by the pistons to such a high pressure and correspondingly high temperature that the fuel oil which is injected just at the completion of the stroke and which has been broken up into minute particles by having passed through an atomizing valve, in coming in contact and mixing with the highly heated air, ignites and in doing so drives the piston on its downward or power stroke. This ignition, however, as some engine builders are careful to state, is not exactly an explosion, but more in the nature of a constant slow combustion. As the pressure of the air in the combustion cylinders ranges from 500 to 800 pounds per square inch, it is obvious that the fuel oil, in order to get into the combustion cylinders, must be subjected to still greater pressure. So it is customary for Diesel engines to be fitted with compressors that will supply air of from 800 to 1100 pounds pressure.



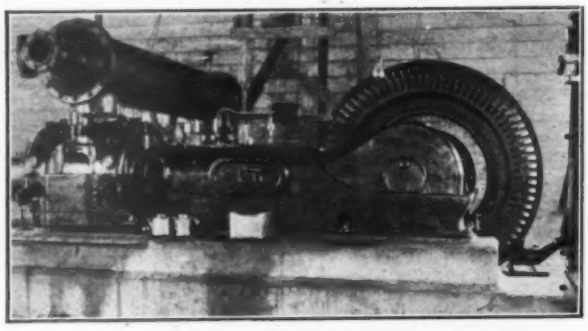
Lubricator Side of a Two-Stage Air Compressor, Showing Oil Pumps. Unit Is Driven by 250-Horsepower, 60-Cycle Synchronous Motor at Speed of 125 Revolutions per Minute.

These compressors are of the multiple-stage type, in which the air is compressed successively through two or three cylinders. In the first cylinder it is compressed to 40 to 80 pounds, in the second cylinder to 200 to 300 pounds, and finally in the third cylinder the pressure reaches 800 to 1100 pounds per square inch. As the air passes through intercoolers in its passage from one cylinder to another it reaches its maximum pressure in a comparatively cool state. The air then passes to steel bottles or containers, which allow any moisture that the air may contain to precipitate and also act as storage reservoirs to draw from when starting the engine. These compressors are usually

connected directly to the main engine shaft and form a part of the engine.

A lubricant which is suitable for the entire Diesel engine, including power cylinders, air compressor and external parts has been developed.

Air compressors exposed to weather conditions, such as those used on electric railway cars, require a



High-Speed Air Compressor Driven by Synchronous Motor at Bengal Mine.

lubricant for winter use which has a low cold test to meet temperature conditions.

Air-Compressor Explosions.

While air-compressor explosions occur at rare intervals, the fact should be emphasized that properly operated and properly cared for compressors are as harmless as steam engines. The cause of isolated explosions is still a disputed matter, though some phases of the question are now generally agreed upon by engineers familiar with air-compressor practice. In the first place, the theory that these explosions are due to the use of an oil with a comparatively low flash point is thoroughly discredited, as they occur more frequently where a high-flash oil is used. In the second place, it is generally agreed that the explosion is due to the accumulation of carbon deposits in the air lines. This deposit in turn is caused either by the use of an unsuitable oil which decomposes, or to the use of an excessive amount of oil, or to the improper location of the air inlet.

The belief that the explosion is always produced by the ignition of a volatile mixture, usually of vaporized oil and air, though possibly of coal dust and air, in the air tanks or lines, is questionable in view of the fact that the small amount of oil volatilized in the air-compressor cylinder would be insufficient to form an explosive mixture with the air, as this volatile matter is constantly being carried off with the air. It could only be in a case where a very excessive amount of oil was used, or where pockets of oily residue were allowed to collect that a sufficient amount of vaporized oil could collect to form with the air an explosive mixture. Even in such a case, the cause of the explosion would not be the vaporized oil, but would be some other factor which produced a spark or flash. The probable source of this spark is again the carbon deposit which may be responsible for a sufficient increase in temperature, by restricting the air passage and thus increasing the pressure, as to cause the carbon to become an incandescent mass. It is not improbable that in some cases this glowing mass of carbon may weaken the tensile strength of the air receiver or the air lines to such an extent that they are no longer able to withstand the pressure of the air, the result being an explosion.

Increasing Demand for Electrical Goods in New Zealand.

A more widespread use of electricity in New Zealand and a greater demand for the various appliances that add to comfortable living are predicted in a report on New Zealand's markets for electrical goods made public lately by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce.

The standard of living is good in the island, says the report, and there is an absence of a poor class, but there are some modern conveniences of which the people have not generally taken advantage. In the electrical field this is quite noticeable, a fact attributed in part to the rigid requirements of the fire underwriters and in part to the natural conservatism of the people.

Of the total imports of $2,300,000 worth of electrical goods in 1913, the United States supplied 15 per cent, England 65 per cent, Germany 5 per cent, and Sweden about 5.4 per cent. In 1914, during which the war made itself felt on shipping, the total imports were valued at $2,136,000, of which the United States contributed 14.4 per cent, England 66 per cent, Germany 8.6 per cent, and Sweden 4.4 per cent. Imports amounted to $1,934,000 in 1915, the first complete year under war conditions, the United States supplying 18.8 per cent, England 70 per cent, Germany 0.7 per cent, and Sweden 4.2 per cent. Japan appeared in the field in 1915 with sales amounting to $12,800. The United States is expected to better its position while the war lasts and after.

The Government report, entitled, "Electrical Goods in New Zealand," Special Agents Series No. 147, analyzes carefully the trade in electrical goods as it has been carried on up to the present and calls attention to a number of shortcomings in American methods that ought to be remedied. Copies can be obtained for the nominal price of 5 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from the district and cooperative offices of the Bureau of Foreign and Domestic Commerce.

PROTECTION AGAINST FLOOD WATERS IN MIAMI VALLEY, OHIO.

Plans Completed and Bids Asked—Electrically Operated Dredges Required.

Miami Conservancy District, with headquarters at Dayton, O., is inviting bids, to be opened November 15, for the construction of five earthen dams, to form that number of retarding basins, and the building of levees on the Miami River and its tributaries, for controlling the flow of that stream, to serve as a protection of Dayton and other cities against the recurrence of the very destructive floods which devastated the Miami Valley in the spring of 1913. The plans of the project have been completed by Arthur E. Morgan, chief engineer, and his corps of about 200 engineers and draftsmen. It involves the handling of approximately 20,000,000 cubic yards of material, and the cost is estimated at $20,000,000. It is proposed to construct earthen dams by the use of hydraulic dredges to be electrically operated. The sources of the required electric power have been figured on and designated. Another phase of the proposed work consists, ultimately, in deepening certain sections of the river channel with dredges.

Census of Electrical Manufactures Shows Big Advance

Complete Data Just Made Public on the Year 1914 and Comparisons with Earlier Statistics

THE Bureau of the Census of the Department of Commerce, under the caption of Census of Manufactures, 1914, has just published and is distributing an elaborate report covering the manufacture of machinery, apparatus and supplies for use in the generation, transmission or utilization of electric energy. In addition to dynamos, transformers, switchboards, motors, and batteries for its generation, regulation, application and storage, the general utilization of electric energy for supplying power, transportation, light, heat, intelligence, etc., involves the use of a vast variety of electrical manufactures, such as insulated wire and cables, starting and controlling apparatus, electric measuring instruments, telephone and telegraph apparatus, incandescent and arc lamps, electric heating and cooking apparatus, flatirons, therapeutic apparatus, circuit fittings and other supplies. The report takes no cognizance of the manufacture of poles, glass and porcelain ware for electrical purposes, the drawing of copper wire, nor the production of electrochemical and electrometallurgical products. Statistics of electric lighting fixtures made in establishments engaged primarily in their manufacture are not included in this report, but are shown separately in the general report on manufactures.

Comparison With Earlier Censuses.

Table 1 summarizes the statistics of establishments engaged in the manufacture of electrical machinery, apparatus and supplies for each census from 1889 to 1914, and gives percentages of increase. As published in the census report comparisons with still earlier censuses are included.

Electrical apparatus first appeared among the classified industries in the census of 1850, when two establishments, engaged primarily in the manufacture of electromagnetic instruments, were reported with products valued at $5,100. In the census of 1860 there were four establishments with products valued at $59,000, but in the census of 1870, which covered the year 1869, the industry was not separately reported. In the census of 1879 there were 76 establishments reported as engaged in the manufacture of electrical apparatus and supplies, including telegraph and telephone apparatus. These establishments gave employment to 1271 wage earners, and their products were valued at $2,655,036. The industry increased rapidly during the 25 years covered by Table 1.

The decrease in proprietors and firm members for 1914 as compared with 1909 is in keeping with the tendency to incorporate the business of firms and individuals, more particularly the former, the proprietors and firm members becoming officers and managers of incorporated companies. Contract work is a relatively small item and may show considerable increase or decrease at different censuses, depending upon the methods followed during the respective years.

Although in most items the per cent of increase for 1909-1914 is less than that for 1904-1909, on account of the larger base on which the former is computed, the actual gains for 1914 as compared with 1909 for every item, except number of establishments, proprietors and firm members, capital and contract work, exceed the gains for any prior five-year period.

Summary, by States.

Table 2 summarizes the more important statistics of the industry, by states, arranged according to the value of products reported for 1914. Kentucky, South Carolina, Washington and Tennessee, for which data cannot be shown separately without disclosing the operations of individual establishments, ranked, sixteenth, nineteenth, twenty-first, and twenty-second, respectively, in value of products.

Although establishments engaged in the manufacture of one or more of the various classes of products embraced in this industry were reported from 33 states and the District of Columbia in 1914, the industry was largely centralized, as in 1909, in the six states of New York, Illinois, Pennsylvania, Massachusetts, New Jersey and Ohio. These states reported 84.1 per cent of the total average number of wage earners, 85 per cent of the total value of products, and 85.5 per cent of the total value added by manufacture. There were, however, some changes in the relative rank of these states as measured by the value of products in 1914 as compared with 1909. Pennsylvania ranked second in 1909, but third in 1914. Illinois

TABLE 1.

	Number or amount					Per cent of increase.[1]			
	1914.	1909.	1904.	1899.	1889.	1909-1914.	1904-1909.	1899-1904.	1889-1899.
Number of establishments	1,030	1,009	784	581	189	2.1	28.7	34.9	207.4
Persons engaged	144,712	105,600	71,485	(2)	(2)	37.0	47.7	.....	.....
Proprietors and firm members	368	439	400	(2)	(2)	—16.2	9.8	.....	.....
Salaried employees	26,266	17,905	10,619	5,067	(2)	46.7	68.6	109.6	.....
Wage earners (average number)	118,078	87,256	60,466	42,013	8,802	35.3	44.3	43.9	377.3
Primary horsepower	227,731	158,768	105,376	43,674	7,494	43.4	50.7	141.3	.....
Capital	$355,724,756	$267,844,432	$174,066,026	$83,659,924	$18,997,337	32.8	53.9	108.1	340.4
Salaries and wages	109,097,610	69,574,540	42,932,406	25,210,917	5,366,188	56.8	62.1	70.3	369.8
Salaries	35,291,281	20,193,395	11,090,885	4,631,723	(2)	74.8	82.1	139.5	.....
Wages	73,806,329	49,381,145	31,841,521	20,579,194	(2)	49.5	55.1	54.7	.....
Paid for contract work	290,889	368,049	266,410	(2)	(2)	—21.0	38.2	.....	.....
Rent and taxes (including internal rev.)	3,286,870	1,962,722	[3]1,334,837	(2)	(2)	67.4	47.0	.....	.....
Cost of materials	154,728,076	108,566,404	66,836,926	49,458,272	8,819,498	42.5	62.4	35.1	460.8
Value of products[4]	335,170,194	221,308,563	140,809,369	92,434,435	19,114,714	51.4	57.2	52.3	383.6
Value added by manufacture	180,442,118	112,742,159	73,972,443	42,976,163	10,295,216	60.0	52.4	72.1	317.4

[1]A minus sign (—) denotes decrease. [2]Figures not available. [3]Exclusive of internal revenue. [4]Not including the value of electrical machinery, apparatus and supplies made in establishments primarily engaged in other industries, to the value of $24,261,961 for 1914; $18,728,916, for 1909; $18,742,033, for 1904; and $13,397,430, for 1899.

TABLE 2.

State.	Number of establishments.	Wage earners. Average number.	Wage earners. Per cent distribution.	Wage earners. Rank 1914.	Wage earners. Rank 1909.	Value of products. Amount.	Value of products. Per cent distribution.	Value of products. Rank 1914.	Value of products. Rank 1909.	Value added by manufacture. Amount.	Value added by manufacture. Per cent distribution.	Value added by manufacture. Rank 1914.	Value added by manufacture. Rank 1909.
United States	1,030	118,078	100.0	..	..	$335,170,194	100.0	..	..	$180,442,118	100.0	..	..
New York	215	23,738	20.1	1	1	73,944,708	22.0	1	1	35,919,949	19.9	1	1
Illinois	142	16,483	13.9	3	5	45,667,456	13.6	2	5	26,288,292	14.6	3	5
Pennsylvania	105	14,866	12.6	4	4	44,395,789	13.2	3	2	27,155,769	15.1	2	2
Massachusetts	91	17,125	14.5	2	2	43,869,294	13.1	4	4	26,172,387	14.5	4	3
New Jersey	76	14,405	12.2	5	3	40,740,810	12.2	5	3	20,191,534	11.2	5	4
Ohio	119	12,695	10.8	6	6	36,120,978	10.8	6	6	18,638,730	10.3	6	6
Connecticut	43	5,059	4.3	7	7	14,330,156	4.3	7	7	6,894,026	3.8	7	7
Indiana	41	4,075	3.4	8	8	8,879,178	2.6	8	8	4,948,531	2.7	8	8
Missouri	19	2,560	2.2	9	12	6,643,210	2.0	9	11	4,227,457	2.3	9	10
Rhode Island	13	1,581	1.3	11	9	5,468,065	1.6	10	9	1,674,995	0.9	12	11
Wisconsin	29	2,115	1.8	10	10	5,396,802	1.6	11	10	3,333,082	1.9	10	9
Michigan	35	1,144	1.0	12	11	3,415,500	1.0	12	12	1,675,952	0.9	11	12
California	29	780	0.7	13	13	2,861,653	0.9	13	13	1,301,395	0.7	13	13
Minnesota	17	236	0.2	14	15	748,948	0.2	14	15	401,107	0.2	14	15
West Virginia	4	162	0.1	16	18	566,368	0.2	15	16	382,306	0.2	15	16
New Hampshire	6	228	0.2	15	14	351,877	0.1	17	17	186,869	0.1	17	17
Iowa	5	94	0.1	19	23	234,760	0.1	18	19	147,545	0.1	18	19
North Carolina	4	78	0.1	22	20	177,075	0.1	20	22	70,799	(1)	24	25
Colorado	8	79	0.1	21	..	138,451	(1)	22	..	85,240	0.1	20	..
Maryland	6	66	(1)	24	19	121,034	(1)	24	23	81,343	(1)	23	22
All other states	23	509	0.4	..	..	1,098,082	0.3	..	..	664,810	0.4	..	..

[1]Less than one-tenth of 1 per cent.

advanced from fifth to second place. New Jersey ranked third in 1909 but fifth in 1914, and Massachusetts was fourth at both censuses.

New York was the leading state in the industry, ranking first at the censuses of 1914, 1909 and 1904. During 1914 the state produced electrical machinery, apparatus and supplies to the value of nearly $74,000,000, or more than one-fifth of the total for the United States. The number of wage earners employed in the state increased 25.1 per cent during the census period ending with 1914, while the value of products increased 50 per cent and the value added by manufacture 64.7 per cent.

Illinois showed the most conspicuous gains among the six leading states. The average number of wage earners increased by 6842, or 71 per cent, and the value added by manufacture, $13,090,000, or 99.2 per cent. Although Pennsylvania showed substantial increases in the three items, the state merely held its rank in value added by manufacture, which increased $9,340,000, or 52.4 per cent, and in average number of wage earners which increased 3841, or 34.8 per cent, while in value products, which increased $13,045,000, or 41.6 per cent, it was surpassed by Illinois.

Character of Ownership.

Table 3 presents statistics concerning the character of ownership, or legal organization, of establishments in the industry for 1914, 1909 and 1904.

TABLE 3.

Character of ownership.	Number of establishments. 1914.	1909.	1904.	Value of products. 1914.	1909.	1904.
Total	1,030	1,009	784	$335,170,194	$221,308,563	$140,809,369
Individual	196	178	153	6,469,529	4,808,989	4,738,594
Corporations.	753	720	524	326,501,635	213,088,053	133,777,339
All others	81	111	107	2,199,030	3,411,521	2,293,436
Per cent of total	100.0	100.0	100.0	100.0	100.0	100.0
Individuals	19.0	17.6	19.5	1.9	2.2	3.4
Corporations.	73.1	71.4	66.8	97.4	96.3	95.0
All others	7.9	11.0	13.6	0.7	1.5	1.6

Establishments owned by corporations constituted 73.1 per cent of the total number of establishments reported, and the value of their products represented 97.4 per cent of the total value in 1914, 96.3 per cent in 1909, and 95 per cent in 1904.

In 1914, 97.5 per cent of the total number of wage earners were employed in establishments owned by corporations, 1.9 per cent in those under individual ownership, and but six-tenths of 1 per cent in those under other forms of ownership, chiefly firms.

Size of Establishments.

The tendency of the industry to become concentrated in large establishments is indicated by the statistics given in Table 4.

Establishments with products valued at $1,000,000 and over were the only class which increased in every particular not only as to actual numbers and amounts but in the percentages which these formed of the totals for the industry.

Of the 1030 establishments reported for 1914, 53 manufactured products valued at $1,000,000 or over. In 1909 there were 31 establishments of this class out of a total of 1009; and in 1904, 22 out of 784. While such establishments represented but a comparatively small proportion of the total number at each census, they reported 67.5 per cent of the total value of products in 1914, 57.1 per cent in 1909, and 60.5 per cent in 1904.

The average value of products per establishment increased from $179,604 in 1904 to $219,335 in 1909, and to $325,408 in 1914, and the average value added by manufacture, as computed from the figures in Table 1, from $94,353 in 1904 to $111,737 in 1909, and to $175,186 in 1914.

TABLE 4.

Value of product.	Census-year.	Number of establishments.	Average number of wage earners.	Value of products.	Value added by manufacture.
All classes	1914	1,030	118,078	$335,170,194	$180,442,118
	1909	1,009	87,256	221,308,563	112,742,159
Less than $5,000	1914	156	204	440,280	254,658
	1909	150	256	395,175	234,882
$5,000 to $20,000	1914	249	1,329	2,785,685	1,715,664
	1909	287	1,473	3,209,873	1,924,861
$20,000 to $100,000	1914	292	5,867	14,211,891	7,951,750
	1909	309	6,474	14,715,392	8,456,335
$100,000 to $1,000,000	1914	280	33,223	91,529,234	49,290,339
	1909	232	28,108	76,612,783	41,436,270
$1,000,000 and over	1914	53	77,455	226,203,104	121,229,707
	1909	31	50,925	126,375,340	60,689,810
Per cent distribution:					
Less than $5,000	1914	15.1	0.2	0.1	0.1
	1909	14.9	0.3	0.2	0.2
$5,000 to $20,000	1914	24.2	1.1	0.8	1.0
	1909	28.4	1.7	1.5	1.7
$20,000 to $100,000	1914	28.4	5.0	4.2	4.4
	1909	30.6	7.4	6.6	7.5
$100,000 to $1,000,000	1914	27.2	28.1	27.3	27.3
	1909	23.0	32.2	34.6	36.7
$1,000,000 and over	1914	5.1	65.6	67.5	67.1
	1909	3.1	58.4	57.1	53.9

Special Statistics Relating to Products.

Table 5 summarizes the statistics for 1914, 1909, 1904 and 1899, relative to the different kinds or groups of electrical machinery, apparatus, and supplies, for which separate totals were compiled at the census of 1914.

In the following tables pertaining to products the total production is given, including that made as a subsidiary product in establishments classed under other industries.

The statistics given in Table 5 do not include porcelain electrical supplies manufactured in the clay-working industries, reported by the United States Geological Survey, to the value of $4,130,270 for 1914, nor the value of 10,461,843 dozen globes and 79,211 gross of battery jars accredited to the glass industry.

In comparing statistics at the different censuses allowance should be made, particularly in the case of some of the less distinctive products, for changes in the schedule of inquiry used, and for the fact that it is possible that all manufacturers did not classify their products in the same way. It is highly probable that many articles specifically called for were not reported separately, and are included in the item "all other electrical machinery, apparatus and supplies."

TABLE 5.

Products, total value	1914. $359,432,155	1909. $240,037,479	1904. $159,551,402	1899. $105,831,865
The electrical industry—Electrical machinery, apparatus and supplies	335,170,194	221,308,563	140,809,369	92,434,435
Subsidiary electrical products of other industries	24,261,961	18,728,916	18,742,033	13,397,430
Dynamos	23,233,437	17,231,804	12,824,768	10,852,323
Transformers	13,120,065	8,801,019	4,468,567	2,962,871
Rheostats, resistances, controllers, motor-starting and speed-controlling devices, feeder-potential regulators and reactances	9,543,224	[1]2,674,963	[1]932,925	[2]1,186,878
Generator-voltage regulators	245,154	[3].....	[3].....	[3].....
Rectifying apparatus, including rotating commutators, electric valves, mercury rectifiers and vibrating commutators	147,965	[3].....	[3].....	[3].....
Switchboards, panel boards and cut out cabinets for light and power	8,989,111	5,971,804	3,766,044	1,846,624
Motors	44,176,235	32,087,482	22,370,626	19,505,504
Batteries	23,402,455	10,612,470	4,243,893	3,679,045
Storage	13,080,964	4,678,209	2,645,749	2,559,601
Primary	10,321,491	5,934,261	1,598,144	1,119,444
Carbons—Furnace lighting, brushes, battery and miscellaneous	3,602,741	1,934,864	2,710,935	1,731,248
Arc lamps	742,142	1,706,959	1,574,422	1,827,771
Searchlights, projectors and focusing lamps	2,081,545	935,874	114,795	225,635
Incandescent lamps	17,350,385	15,714,809	6,953,205	3,515,118
Sockets, receptacles, bases, etc.	5,512,609	4,521,729	2,010,860	593,929
Electric-lighting fixtures[4]	3,383,955	2,200,668	3,294,606	3,750,670
Telegraph apparatus	2,248,375	1,957,432	1,111,194	1,642,266
Telephone apparatus	22,815,640	14,259,357	15,863,698	10,512,412
Insulated wire and cables	69,505,573	51,624,737	34,519,699	21,292,001
Electric heating, cooking and welding apparatus, including flatirons	4,048,915	1,954,112	395,827	[3].....
Electric measuring instruments	8,786,506	7,800,010	5,004,763	1,842,135
Electric locomotives, mine and railway	[5]3,720,914	[3].....	[3].....	[3].....
Electrical therapeutic apparatus	2,653,098	1,107,858	1,036,962	[3].....
Magneto ignition apparatus, spark plugs, coils, etc.	22,260,847	6,092,343	678,077	[3].....
Electric switches, signals and attachments	6,393,551	5,377,843	1,451,337	1,129,891
Annunciators	263,806	235,567	185,870	224,885
Electric clocks and time mechanisms	410,774	352,513	373,926	132,149
Electric conduits, underground and interior	4,874,709	5,098,264	2,416,245	1,066,163
Lightning arresters	1,188,773	940,171	587,124	595,497
Fuses	1,757,430	1,001,719	868,079	
Circuit fittings of all kinds	2,067,683	1,080,287	3,525,446	[3].....
All other electrical machinery, apparatus and supplies	27,276,294	18,995,176		
All other products, including amount received for custom work and repairing	23,628,244	17,765,645	26,267,509	15,716,850

[1]Rheostats and resistances only. [2]Rheostats and resistances, and heating and welding apparatus. [3]Figures not available. [4]Not including fixtures made by establishments engaged primarily in the manufacture of "gas and electric fixtures." [5]Number, 900.

The more important classes of products are treated separately in tables presenting statistics of production in detail.

Table 6 shows, for 1914 and 1909, the value of the various kinds of electrical apparatus included in the totals shown in Table 5, which were manufactured by establishments in other industries as subsidiary products.

TABLE 6.

Kind.	Subsidiary electrical products (establishments included under other industry classifications). 1914.	1909.
Number of establishments	91	142
Total value	$24,261,961	$18,728,916
Dynamos and dynamo parts and supplies	1,668,523	2,111,542
Switchboards for light and power	98,098	224,452
Motors and parts and supplies	900,683	1,213,761
Insulated wires and cables	18,183,964	11,374,165
Magneto-ignition apparatus, spark-plugs, coils, etc.	105,541	79,183
Electric locomotives	847,370	.....
Other electrical machinery, apparatus and supplies	2,321,255	3,691,453
Custom work and repairing	136,527	34,360

TABLE 7.

	Dynamos, Parts and Supplies. 1914.	1909	1904.	1899.
Total value	$23,233,437	$17,231,804	$12,824,768	$10,852,323
Alternating current:				
Dynamos—				
Number	2,137			
Kilowatts	587,820			
Value	$3,542,154	2,900	1,324	1,345
Generators for direct connection to steam turbines—		991,728	355,832	256,673
Number	375	$8,370,524	$4,111,104	$4,174,651
Kilowatts	600,185			
Value	$3,895,291			
Direct current:				
Dynamos not elsewhere specified—				
Number	9,369			
Kilowatts	206,305			
Value	$2,569,086			
Generators for direct connection to steam turbines—		13,882	13,756	9,182
Number	264	414,222	640,350	321,451
Kilowatts	14,916	$4,710,524	$6,973,130	$6,297,925
Value	$398,379			
Small dynamos and automobile starter generator sets[1]—				
Number	208,545			
Value	$5,933,273			
Dynamotors, motor generators, boosters, rotary converters, double current generators, synchronous condensers and rotary-phase converters:				
Number	8,393	2,291	2,135	649
Kilowatts	780,009	295,079	209,664	10,798
Value	$5,367,895	$3,154,733	$1,740,534	$379,747
Parts and supplies, value	$1,527,359	$996,623	[2].....	[2].....

[1]Figures for capacity not available; fraction of kilowatt. [2]Figures not available.

The statistics with regard to dynamos are shown in Table 7. The group also includes a large number of small dynamos of a fraction of a kilowatt capacity and starter-generator sets for automobiles. With respect to the latter, it does not include those made and installed by the automobile manufacturers. The growth in direct-current dynamos has been chiefly confined to the small units.

Editorial Comment

Making Service Connections Satisfactory

GOOD WILL is a most desirable asset on the part of a central station just as it is of any business enterprise. The amount of good will shown to a central station will depend almost entirely on those features of its service which come to public notice, such as the quality of the service, the rates charged for it, the conduct of employees who come in contact with the public, and the character of the central-station equipment exposed to public view on the streets and in service connections to its customers. This latter feature is one very commonly neglected by the utility companies, and yet, this forms the most conspicuous part of the plant. It is due to this neglect that one finds so strong a clamor in many communities for ridding the streets of all overhead wires.

The outside plant is not only continually in the public eye and therefore subject to critical comment, but it represents a most substantial part of the entire central station's investment. The central station therefore must at all times carefully balance the two conflicting policies of increasing the investment in the distribution system to make it strong, neat and unobjectionable from the public standpoint, and of minimizing the expenditures for this part of the equipment so as to prevent this investment from becoming prohibitively unremunerative. In most cases, we believe, more emphasis has been placed on the latter with the result that the demand for underground construction has been raised in every large city.

That there is room for harmonizing these conflicting ideas to the mutual advantage of all concerned is self-evident to anyone who has given this matter study. It is worthy of much more general consideration, however, and we are pleased to announce that in three articles especially prepared for our readers by E. B. Meyer this subject is discussed in considerable detail, especially as it concerns the question of service connections from the distribution system. The first of these articles by Mr. Meyer appears in this issue. He points out how overhead service connections can be made neat and unobjectionable in many cases at no additional expense and in some instances at an actual saving. Mr. Meyer's suggestions apply with special emphasis to those cities, common in the East, where there are no alleys, and pole lines must therefore be run along streets or at the edges of private property, clearly a most difficult problem. His ideas can also be used, however, in cities where alleys abound. In future articles Mr. Meyer will deal with underground service connections and with the actual service and meter installation on the customer's premises. These are all points of great interest and we therefore commend careful reading of these three articles.

Water-Power Legislation

THE difficulties in securing supplies of coal, coming coincident with the enormous demand for supplies and for manufacturing facilities of all kinds, accentuate the need for developing all of the water power which it is possible to utilize. Much of the available water power of the country cannot be developed without enabling federal legislation which Congress has so far failed to enact. In the stress of war times it is all too likely that this subject will not receive the attention of Congress, but no avenue of approach for impressing upon our national legislators the importance of prompt and decisive action should be left untried.

Congressional action is necessary not only for developments on navigable streams and for those requiring the use of public lands, but also for further development of the Niagara River, which is so needed by the industries built up at that point. These industries are largely electrochemical, and it is appropriate that the American Electrochemical Society should, at its last annual meeting, have passed a resolution not only urging greater development at Niagara Falls, but calling for careful consideration of the electrochemical industries in deciding the question.

The Society has recently published a pamphlet in which are contained not only this resolution, but a number of appendices showing the importance of the electrochemical industries to the nation, the difficulties in the way of securing the cheap power necessary for their expansion, and the real heart of the diversion problem at Niagara Falls. The conservation of scenic beauty and the greater utilization of power can both be accomplished by appropriate procedure. The necessary action should be taken by a commission representing both Canada and the United States. Such a definite policy and vigorous action are necessary, as distinguished from piecemeal diversion and temporary expedients. The Society's pamphlet deserves wide distribution.

Adequate development of our water-power resources is one of the vital problems confronting the nation today and all electrical organizations should take an active part in bringing the facts before the public so that a definite Governmental policy can be adopted that will aid rather than hinder this necessary development.

Trading With The Enemy

SO MUCH confusion has arisen among business men as to the provisions of the Trading With the Enemy Act that an official interpretation of the law, bearing directly upon the issuing of licenses, has been issued by the Bureau of Enemy Trade for the guidance of business men, including of course all manufacturers and distributors of electrical equipment.

In explanation of the law dealing with licenses for those who wish to engage in business with the enemy, the statement of the Bureau of Enemy Trade may be summarized as follows:

A "trading with the enemy license" is required when any person in the United States desires to trade directly or indirectly with, to or from, or for, or on account of, or on behalf of, or for the benefit of, any other person with knowledge or reasonable cause to believe that such other person is an "enemy" or "ally of enemy," or is conducting or taking part in such trade directly or indirectly, for, or on account of, or on behalf of, or for the benefit of any "enemy" or "ally of enemy."

The act defines "enemy" and "ally of enemy" as any person, no matter of what nationality, who resides within the territory of the German empire or its allies, or that occupied by their military forces. Even a citizen of the United States who has elected to remain within such territory is an "enemy" or "ally of enemy" within the provisions of the act.

Further, any person residing outside of the United States, of whatever nationality and wherever he resides, who is doing business within such territory, is within the statutory definition of "enemy" or "ally of enemy." So, also, is any corporation created by any other nation than the United States which is doing business within the territory of Germany or its allies, or in territory occupied by the military and naval forces thereof.

Further, for the purposes of the act, the government of any nation with which the United States is at war, the government of any ally of such nation or any subdivision of any such government, and any officer, agent or agency of such government is an "enemy" or "ally of enemy," and the act makes no restriction as to where the officer, agent or agency may be located.

Citizens or subjects of "enemy" or "ally of enemy" nations resident in the United States are not "enemies" or "allies of enemies" merely by reason of their citizenship, and all the persons in the United States may continue their commercial relations with such subjects of Germany and its allies without applying for or securing licenses, until there are other facts than citizenship present which bring them within the definition of "enemy" or "ally of enemy" set forth above, or unless the President should exercise the power granted to him by statute to extend the definition of "enemy" and "ally of enemy" by proclamation to include such person.

The War Revenue Tax

IN ADDITION to the unjust and un-American zone system of second-class postage there are features of the new War Revenue Tax bill recently passed by Congress which were evidently not contemplated by either the House or Senate. In a portion of the bill it is now discovered that the professional man or the ordinary worker without capital using only his brains, will be compelled to pay an excess-profits tax in addition to his income tax. Any man receiving a salary above $6000 is not only compelled to pay an income tax but also to pay an excess-profits tax of 8 per cent.

There are other errors and uncertainties in this bill. Among these, American Industry in War Time speaks of the following in a recent issue:

The question of ambiguity comes up in the determination of invested capital. It provides in one place that where good will, trade-marks, trade brands, franchises of a corporation or partnership or other intangible property is purchased through issuance of stock, only 20 per cent of the total stock of the corporation purchasing such assets shall be included in invested capital. Now under the ordinary interpretation of the law stocks are regarded as intangible property. Therefore, where a corporation issues its own stock to purchase the stock of another company, it would be unable to base its deduction in the matter of this bill on more than 20 per cent of its capital. For example: Under the law a deduction of 7 per cent on the total invested capital is allowed. If a corporation has a capital of $10,000,000, it is allowed to deduct from its net earnings $700,000 and set that aside before the taxes which are levied in the bill are assessed. But, assuming that that corporation had issued that $10,000,000 to purchase the stocks of two or three other corporations, this law apparently provides that it can make this 7 per cent reduction not on $10,000,000, but on 20 per cent of that, or $2,000,000, so that the amount set aside to be deducted is only $140,000, instead of $700,000.

This may not be the intention of the law, but it specifies intangible property, and the law recognizes stocks as intangible property. There are other phases of the bill which would exclude investment in the capital stock of subsidiary or other companies upon which even a very minor dividend was declared and prevent the corporation owning these securities from a fair deduction for the capital which it had invested in such securities.

Fortunately the main purpose of the bill, to create large revenue for the work of carrying on the war, has been secured by its passage and in this all patriotic citizens are in hearty accord. The bill, however, we believe, will have to be modified in several respects at the next Congress.

HAPPENINGS IN THE INDUSTRY

Commonwealth Edison Increasing Capacity—Doherty Talks on War—Annual Meeting of Commonwealth Edison Section—New Toledo Ordinance—Reunion of Edison's Early Associates

COMMONWEALTH EDISON GENERATING EQUIPMENT BEING GREATLY INCREASED.

Existing Plants Being Extended—Orders Placed for New Calumet Station.

Commonwealth Edison Company's plant extensions now in progress, and the new plant construction for which plans have been made, will result in the increase of its generating capacity by 175,000 kilowatts within the next two years. As is generally known by electrical men, this company's activities are confined to the city of Chicago. Its existing plants consist of the Northwest station, Fisk Street, and Quarry Street stations. A new plant, to be known as the Calumet station, for which orders for equipment have been placed, is to be completed in 1919. The site for it is in the southeastern part of the city, in close proximity to numerous industrial plants whose power requirements are great. Plans for the new Calumet station provide for two initial units, each of 22,500 kilowatts, with the usual provision for extensions.

Northwest station, now having four operating units of 105,000 kilowatts, is being increased by the addition of two units of 35,000 and 30,000 kilowatts, respectively. The first of these will be completed and made ready for service early this winter, and the second some time in 1918, making a six-unit station of 170,000 kilowatts.

Fisk Street station is being increased by the installation of two new units, one of 30,000 and the other of 35,000 kilowatts capacity. These are expected to be completed and in operation before the close of 1918. It is understood the projected new plant is to be equipped with horizontal steam turbine driven generators of the most modern type, with all accessories of the latest design, with a view to securing the highest efficiency and consequent economy.

MR. DOHERTY TALKS OF WAR TO JOVIANS.

Says End of Struggle Is Still Far Off and We Must Be Ready to Work Hard and Suffer Much.

Henry L. Doherty, speaking as retiring Jupiter at the annual banquet of the Jovian Order held at the Hotel McAlpin, New York, on the evening of October 23, got away from discussing the electrical industry, and devoted most of his speech to the war and the duty of electrical men to work their hardest to help in its prosecution. For the first time Mr. Doherty gave public expression to his opinion that the struggle between the United States and Germany was not in sight and said that all of us must make up our minds to much hard work and suffering.

Before Mr. Doherty's speech, Dr. Talcott Williams, director of the Pulitzer School of Journalism at Columbia University, talked to the Jovians about the war. Dr. Williams said that the war had been caused by 23 emperors, kings, grand dukes and dukes who were convinced that they were monarchs by divine right, and have therefore plunged the world into a struggle which has brought death, injury and untold sufferings to twenty-three millions of people. He went on to say that these kings believed that they had been made to rule over their respective countries, and Dr. Williams contrasted the situation with that of the Jovian Order which was made for the Jovians rather than having the Jovians made for it. Characterizing the Jovians, Dr. Williams said, "No other industry but the electrical could have an organization like the Jovians." In concluding, the speaker said that he deplored all ideas of the divine right of kings and believed that democracy was the only righteous form of Government. His statement that "We are in this war to decide once and for all which idea is correct" was loudly cheered.

Extracts from Mr. Doherty's speech follow:

I had come to make another speech this evening, but Dr. Williams' remarks have turned my thoughts to the war. I must say, however, that I take exception to some of the things Dr. Williams has said because I am not convinced that this terrible catastrophe of war has come about through the sole action of these 23 rulers to whom Dr. Williams has referred.

I believe that the struggle started because there were too many chesty men in Germany. It was not simply because of the ambition of these 23 rulers, it was because of the chestiness of the German people. I spent considerable time in Germany prior to the beginning of the war, and wherever I went, the efficiency and industry of the German workers was always pointed out to me, and I became convinced that the Prussians believed that they could wage a great world war and at the same time conduct their efficient industries without interruption. This opinion, which I found prevalent throughout Germany, was but one evidence of the overconfidence of the German people, and I therefore attribute to this overconfidence the desire of the German people to fight.

* * *

I am sorry to say that I don't believe that peace will come soon, and I want to caution you against the belief that the end of the war is at hand, as such a belief endangers the effective prosecution of our share in the struggle. We should not believe that Germany is in as bad shape as was the Confederacy one year before the end of the Civil War. But even granting that Germany is that weak, remember how hard the South fought during that last year, and picture how Germany, with her much more perfect military machine, may be expected to fight to the last. I hope that the electrical men realize that peace is not likely to come very soon, and I hope that they will do more than their share to help the Government. Winning the war depends upon men working in this country as hard and

as long as possible. We have to make up our minds to work and suffer here as much as the men in the trenches. I think that the criticism that business is making excess profits out of the war is unjust. I know that the electrical industry has not made excess profits, and I believe that the great mass of business men have been unselfish. They have been criticised because of the acts of a few who tried to get excess profits. Such criticism of the business man tends to create class feeling and that is just what we should avoid. I believe in the rule of real democracy but I look with misgivings upon present democracy. It is not the democracy of Thomas Jefferson, because Jefferson believed that the government which governs least governs best.

ANNUAL MEETING COMMONWEALTH EDISON SECTION, N. E. L. A.

Address by Mr. Insull—Installation of Officers—Awarding of Numerous Prizes.

The annual meeting of the Commonwealth Edison section of National Electric Light Association, Chicago, was held in Customers' Hall, Edison Building, on the evening of October 25. The attendance of between 700 and 800 comprised members of the association, including a number of women employes, many of the Public Service Company members, and lady friends of members. An auspicious feature of the meeting was the beautiful effect of flag, palm and floral decoration of the hall. Music was furnished by the Edison Symphony Orchestra. As introductory to the regular program, the retiring officers and officers-elect entered the hall, followed by sixty employes who are members of Company E, 11th Illinois National Guard, in uniform, led by Captain Herbert A. Fife. They formed in two rows, between which President Samuel Insull advanced to the speaker's stand, while the audience rose, each member waving an American flag. Mr. Insull was accompanied by John P. Hopkins, secretary of the State Council of Defense, and other friends.

First, the flags of the Allied nations were raised, by electrical devices, ingeniously contrived, to positions over the platform. As the Stars and Stripes went into position there was a demonstration of salutes and applause. Then followed Mr. Insull's address, in which he referred to the fact that our nation, with our allies, was engaged in war, which called upon all to bear the burden. Reviewing affairs of the company, he stated it was in excellent financial condition, which he did not doubt could be maintained. Of the 5197 employees of Commonwealth Edison Company, Mr. Insull said 519, exactly 10 per cent, had joined the military and naval forces, and three-quarters of them were volunteers. At this moment a large service flag, with its red border, carrying 519 blue stars on its white field in the center, was let down from the third floor railing, and this received an ovation. The speaker referred to the Liberty Loan, the condition of business as the result of war activities, and predicted that the selling price of utility service, fixed by law, would not be changed. Other phases of the company's relations with the public were discussed. He said the company could now supply 12½ per cent greater output with 10 per cent less fuel than a year ago. This was due to the increased efficiency of new and additional equipment, making a greater volume of business possible, this result largely offsetting the higher cost of fuel.

Addresses were made by W. S. Kline, retiring president of the local section, N. E. L. A., and A. G. de Clercq, president-elect. Committee reports covering the numerous phases of the association's work were read, which were enthusiastically received. The awards of prizes for papers presented were then announced by Mr. Insull, as follows: To K. A. Auty, Insull medal and first prize of $40 for paper on "Advertising Our Kilowatt Hours"; G. B. Springer, second prize, $30, for paper on "Underground Conduit Construction"; Karl Horine, third prize, $20, paper on "Electrolytic Chlorine"; R. L. Frisby, fourth prize, $10, paper on "Generation, Protection and Control."

Prizes for the most meritorious suggestions made by employes and accepted by the company during the six months ended June 30, 1917, were announced by Mr. Insull as follows: J. P. Walsh, Street Department, first prize, $50, for suggestion that when a meter is connected, lights be tested, and all burned-out lamps be replaced by new ones; N. H. Johann, Fisk Street Station, second prize, $40, for suggestion that the company erect a pole on each station, and donate a flag for each pole; H. E. Paaren, Meter Department, third prize, $30, for recommendation of a new system of cutting off meters which are read and disconnected, as men remove the house wire from its binding post and connect it to the neutral binding post, causing building to have two neutrals; F. E. Aurand, Operating Department, fourth prize, $20, for suggestion that a relief valve be placed in the exhaust end of the steam exciter at various stations; L. M. Anderson, Street Department, fifth prize, $10, for greatest number of accepted suggestions, eight having been adopted. Mr. Anderson has won this particular prize four successive times.

The awards of five trophies were next announced by Mr. Insull: Bowling, to Treasury Department team; Baseball, to Repair Department team; Tennis, to E. W. Howland, Testing Department; Rifle Shooting, to Fisk Street No. 1; Golf, to F. X. Metenet, Contract Department.

NEW STREET-CAR ORDINANCE FOR TOLEDO FRAMED.

New Company to Be Formed to Operate on Community Plan—Public to Purchase Stock—Features of Ordinance.

After working eighteen months on the draft of a trolley ordinance for Toledo, an agreement has been reached between that city's special traction committee and the Toledo Railways & Light Company, whereby a "community ownership" system is outlined. The agreement as drawn up by the consultants, contemplates the creation of an entirely new relation between a public utility and a city, as it embodies various original ideas. These include principally, the creation of a new company, to be known as the Community Traction Company, which will operate under a 25-year franchise, this franchise providing that at the end of five years the traction property may be purchased or leased by the city.

The ordinance as drawn up will be printed and distributed to the voters so that they may thoroughly understand the proposed agreement. After the valuation of the property, the question of enacting the proposed ordinance will be voted upon at a referendum. Before the final ordinance is submitted to a vote, the car commission will receive suggestions and modifications of the plan which may be made by the public. It thus seems possible that within a comparatively short time, the long pending traction problem in Toledo will be settled.

As decided upon under the personal co-operation of Henry L. Doherty, the proposed regulations for the street railway are very elaborate. The most important features of the plan are these:

(1) There is to be a separation of the street railway company from the electric and gas properties of the Toledo Railways & Light Company. The traction properties are to be controlled by a corporation which is to be called the Community Traction Company, the capital stock of which is to equal the value of the street railway properties as determined by the valuation board. This stock will be held by five trustees to be named in the final ordinance, and the stock will be voted by them. In return for its equity in the Community Traction Company, the Toledo Railways & Light Company is to receive trust certificates.

(2) The stock of the Community Traction Company will be sold to the public in $10 shares, and may be bought by anyone upon the installment plan. It is further provided that this stock must always yield an income of 6 per cent, unless such yield cannot be obtained without increasing the fare to more than 5 cents.

(3) At the end of five years, the city may at any time purchase the traction properties for an amount equal to the par value of the capital stock of the company issued and outstanding, plus a premium of 6 per cent. In addition, the city shall assume all debts and obligations of the company contracted in good faith.

(4) At any time after five years, the city may lease the property of the Community Traction Company by paying 25 per cent of the purchase price as determined in the above paragraph, plus a monthly rental of one-half of one per cent on the unpaid balance of the purchase price. In order to acquire the property, the city will also have to pay at least 2 per cent annually toward such purchase.

(5) The Toledo Railways & Light Company agrees to purchase within the first 18 months, $1,000,000 of additional stock in the Community Traction Company. Money received from the sale of this stock is to be used to pay for extensions and betterment of the lines during the first five years. Further funds are created to take care of operation, maintenance, depreciation and renewals.

(6) It is provided that the cash fare on the Community Traction Company's lines may never be in excess of, or less than 5 cents. With the cash fare remaining stationary, any changes in fare will be made by adjusting the number of tickets which may be purchased for 25 cents, and by regulating the issuance of transfers. The highest fare contemplated in the ordinance, is to be a 5-cent fare with a free transfer. This maximum fare is graduated down to the minimum rate which is a 5-cent cash fare, 10 tickets for 25 cents, one cent charge for a transfer with ticket fare, and no rebate. A rate of fare to begin with will be established by the final ordinance, and any future modifications of the rate will depend upon the action of the city and the condition of the equalizing fund as outlined in the following sections.

(7) The rate of fare established when the ordinance goes into effect shall continue for six months, or until the company shall have accumulated a fund of $150,000 after deducting taxes, allowances, dividends and various other payments. That fund will be known as the "Equalizing Fund." The minimum level of this fund will be $100,000 and the maximum $200,000. When the fund reaches the minimum level, the company may put into effect the next higher rate of fare, but if the council rejects the increased fare the matter must be arbitrated. When the fund reaches the maximum level of $200,000, all surplus is to be deposited in the amortization fund or the city council may decrease the rate of fare. The maximum, intermediate and minimum levels of this fund are subject to change when the capital stock of the company exceeds $7,500,000.

(8) The amortization fund is to be similar to a sinking fund. Whenever the franchise has only 15 more years to run before its expiration, the company is to pay an amount each year into this amortization fund. For example, if at the end of the first 10 years of the present 25-year franchise, no provision has been made for the renewal of the franchise, the company must begin its monthly payments to the amortization fund, which fund is to be held by the five trustees. The payment into the amortization fund is not to exceed in any month more than one-half of one per cent of the capital value, and the total to be raised during the 15 years is not to be more than 75 per cent of the capital value.

(9) The city council is to have supervisory powers in regard to service. There are provisions for arbitrating all matters in dispute, and arbitration is to be enforced by withholding one-sixth of the dividends until the company complies with the award.

PRICE OF COAL AT MINES ADVANCED BY THE PRESIDENT.

A Raise of 45 Cents Per Ton Authorized, with Certain Exceptions.

The President has issued the following order:

The White House, Washington, D. C., Oct. 27, 1917.

The scale of prices prescribed August 21, 1917, by the President of the United States for bituminous coal at the mine, as adjusted and modified, by order of the United States Fuel Administrator, to meet exceptional conditions in certain localities, is hereby amended by adding the sum of 45 cents to each of the prices so prescribed or so adjusted and modified, subject, however, to the following express exceptions:

(1) This increase in prices shall not apply to any coal sold at the mine under an existing contract containing a provision for an increase in the price of coal thereunder in case of an increase in wages paid to miners.

(2) This increase in prices shall not apply in any district in which the operators and miners fail to agree upon a penalty provision, satisfactory to the Fuel Administrator, for the automatic collection of fines in the spirit of the agreement entered into between the operators and miners at Washington, October 6, 1917.

This order shall become effective at 7 a. m. on October 29, 1917.

(Signed) WOODROW WILSON.

Bids on Power Equipment Rejected.—Bids recently submitted to the flood-water reclamation district at Gregory, Mo., for power equipment, required in the operation of pumps, were all rejected by reason of the length of time specified in which delivery could be made. Bids were received on oil engines, steam-power equipment and electric motors. The use of motors was contingent upon the district being able to secure a transmission line from the plant of Mississippi River Power Company.

REUNION OF EDISON'S EARLY ASSOCIATES.

Meet at Dedication of Tablet Commemorating Thirty-Fifth Anniversary of Electric Lighting.

With appropriate ceremonies a large bronze tablet commemorating the thirty-fifth anniversary of the establishment of electric lighting in New York City was dedicated at the New York Electrical Exposition on October 18. Among the speakers were Borough President Marcus M. Marks, George F. Kunz, president of the American Scenic and Historic Preservation Society, and Edward Hagaman Hall, its secretary; President John W. Lieb of the National Electric Light Association; Reginald Pelham Bolton. President Arthur Williams, of the Electrical Exposition, presided.

A feature of the exercises was the gathering of 22 of the men who worked with Edison in establishing the first central station at 257 Pearl Street, where the tablet is to be placed later. Some of these men are now executives of big electrical companies. All cheered enthusiastically when the announcement was made that their old boss, Tom Edison, was too busy helping to win the big war to have time to attend the event.

Among the central-station pioneers who gathered at the reunion were William J. Hammer, Schuyler S. Wheeler, E. A. Harley, H. A. Campbell, Joseph Lee, A. T. Brown, O. J. P. Lang, A. E. Gilbert, W. J. Brown, J. F. Atkins, T. T. Wooley, John Acheson, Wilson S. Howell, Richard Darlington, Thomas Brown, W. T. Dempsey, Mrs. Nellie Curran, Andrew Brown, John W. Lieb, Arthur Williams.

President Marks paid a glowing tribute to the co-operation which the Edison Company has so freely given toward the development of the great municipality. Messrs. Lieb and Williams told many interesting and amusing incidents concerning Edison in the early days which the tablet commemorates.

The Edison Tablet.

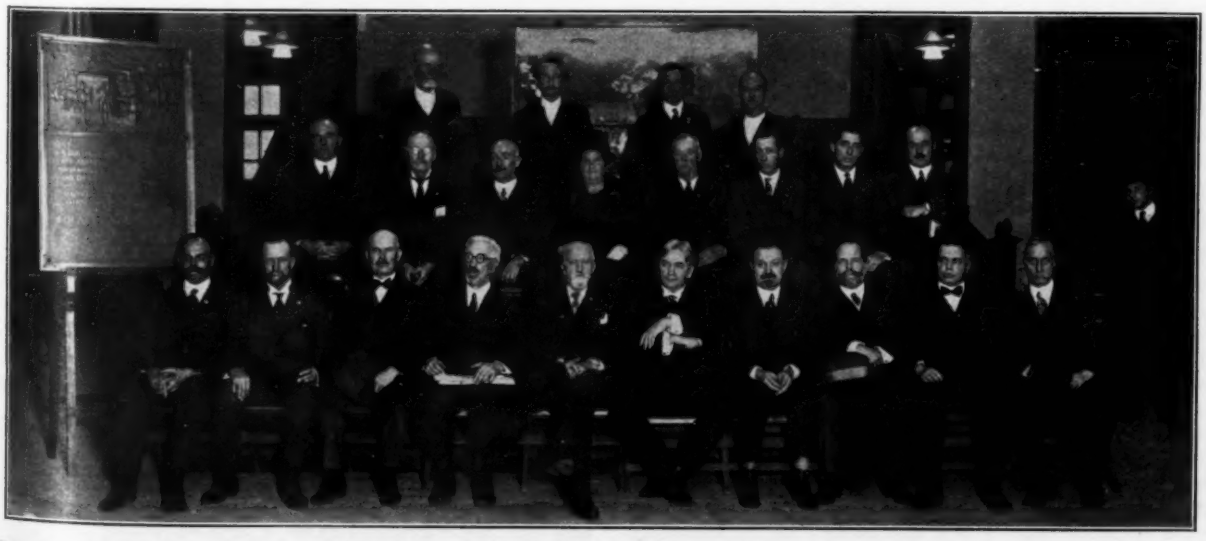
The bronze tablet will be erected at 257 Pearl Street, New York, marking the site of the first Edison electric power plant and commemorating the beginning of Edison service in the metropolis. The bas-relief at the top of the tablet shows the interior of the old station. The generators, six in number, were each of 125 horsepower. The territory served by the station was only a square mile in area and when the station began operation there were only a thousand lights on the system.

The station and the distribution system were laid out according to the plans of Edison, and Edison himself supervised the work of construction. At times when the pressure of work was great, he slept on a pile of material in the building.

The old building, which has been reconstructed, is now occupied by the firm of Mangus, Maybee & Renard, dealers in oils. In erecting the tablet, the American Scenic and Historic Preservation Society and the New York Edison Company have co-operated.

Minnesota Engineers Welcome Dean John R. Allen.—Representatives of fifteen engineering societies of Minnesota, to the number of over 100, attended a Welcome Dinner at Radisson Hotel, Minneapolis, on October 18, in honor of John R. Allen, the new Dean of the College of Engineering and Architecture of the University of Minnesota. The engineers and architects in attendance represented the American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Civil Engineers, American Institute of Architects, Minnesota Surveyors and Engineers' Society, Minnesota Electrical Association, Minnesota State Highway Commission, Minnesota Joint Engineering Board, Engineering Bureau of League of Minnesota Municipalities, Engineering Alumni Association of University of Minnesota, Engineers' Club of Minneapolis, Civil Engineers' Society of St. Paul, Society of Automobile Engineers, Gargoyle Club of St. Paul.

Discussion of Code Changes.—At the meeting of the Philadelphia Electrical Conference held on the evening of October 26, Washington Devereux made an address explaining the changes in the 1917 National Electrical Code. Mr. Devereux had just come back from the meeting of the Electrical Committee, held in New York City on October 23 and 24, and gave for the benefit of his audience a complete and first-hand summary of all the important changes.



Reunion of Twenty-two Early Associates of Edison in Establishing the First New York Central Station—Memorial Tablet is Shown at Left.

Notes on Commercial Practice

New-Business Methods, Policies, Rates and Kindred Central Station Matters for the Man Engaged in Selling Electricity

Compensation for Central-Station Salesmen.

The establishment of a model plan of compensation upon a straight salary basis is comparatively an easy matter, inasmuch as the principal questions involved in any given territory are the amount of money to be expended and the number of men necessary to take care of the business in that territory, knowledge of local conditions governing the last point. With an average figure as a basis, the variables can be applied in such a manner as to obtain the proper salary for each man. The fundamental facts relating to such a plan will consist of a given appropriation representing a certain percentage of gross sales and bearing a certain relation to past annual increases in gross sales. The amount will be subdivided into expense and salary items composed of individual expense accounts and graded salaries.

The working out of a model schedule of compensation upon a straight or partial commission basis involves the solution of complex problems. Attempts to apply schedules in use in other localities and developed under conditions not truly comparable, will result in failure, just as attempts to adopt ready-made commission methods in the ordinary merchandising field have proved unsatisfactory. It may be argued that since the work of any salesman can be measured by the revenue or profit resulting from his sa'es, there should be little difficulty in assigning a value to his results and in working out a model schedule of compensation to fit any given territory. Now, in any given territory the new business results may cover as wide a range as a proportion of 10 to 1 between the highest and lowest record made by salesmen. The lowest record may represent the hardest work and the best salesmanship, consequently a proper system of handicaps is the only remedy to assure equal compensation for equal efforts. Again, it is true that any model plan which simply results in paying salesmen practically what they have been getting under some other method, is not necessarily a successful plan. The true object of any method of compensating sales efforts is constructive business building, and the plan must be good enough to sell itself to the salesman and remain sold. It must not only satisfy in the present, but offer a continuous incentive for self education, self development and efficiency and consequently represent a powerful sales force in the organization where it is used.

In ordinary business, commissions are allowed upon the basis of a percentage of the selling price of the unit articles, this percentage being based upon the profit per unit of the various commodities sold. The unit article manufactured or sold in our electric business is the kilowatt-hour, but this unit varies in cost, selling price and profit according to the classes of business in which the sales occur. Any system of compensation must, as far as possible, take into consideration the differences mentioned or it will not be fair to the company. A dollar of revenue coming from the sale of a given number of kilowatt-hours in one class of business may be very much more desirable revenue than a dollar representing the sale of a greater or less number in another class of business. It is also true that the ratio of the respective value of revenue in different classes of business may not be the same in any two territories. It consequently is necessary for each company to prepare carefully tabulated data covering the value of revenue and of connected load in the main subdivisions of their business as well as data covering past sales results before attempting to work out a model plan of compensation.

Possible Appliance Sales for Central Stations in Cities of 30,000 or Less.

There are a surprising number of small central stations which do not sell electrical appliances. During the last six months of 1916, specific requests were made by small central stations to various manufacturers, to furnish figures which could be used in estimating the possible volume of the local appliance business.

Central-station merchandising conditions vary in different parts of the country, as shown in the accompanying table.

The small central stations which handle electrical appliances feature one line of heating apparatus. There are several reasons for this. Their buying is done from a jobber and as a rule the jobbers handle and push one line exclusively. Heating apparatus is sold by the jobber on a sliding scale and this has a tendency to concentrate buying. Then, from an advertising point of view, better co-operation is received by lumping business with one manufacturer.

It was found by a committee of the National Electric Light Association that a figure equal to 50 per cent of the preferred manufacturer's business must be added to include business done with the manufacturers of other heating appliances.

Business done with vacuum cleaners, washing machines, sewing-machine motors, electric fans, etc., was treated as a separate subject. This type of business has not been developed and after investigation it was found that a figure equal to 50 per cent of the total appliance business must be added to include this apparatus.

The estimate of total electrical merchandising business per residential connection, for average cities of 30,000 or less, arranged geographically, is as follows:

North Atlantic States	$0.506
Southern States	.675
Middle Western States	.900
Southwestern States	.484
Pacific and Rocky Mountain states	1.744

These figures establish a fair quota for any small central station wishing to sell electrical merchandise and yet not equipped with a special organization to handle this work. However, certain manufacturers report that in some cases they get as high as one dol-

lar's worth of business per residential connection. The figures given do not cover portable lamps.

It is urged that small lighting companies arrange their organizations so that responsibility for the merchandising work will rest upon one person. It is further suggested that the necessary changes be made in the company's accounting methods, to allow for the segregation of the merchandising business into separate accounts. This department should be charged its pro rata share of rent, light, interest on investment, time of employes who handle this work, etc.

Window Displays.

Small companies are urged to use the window display service furnished by the various manufacturers. Advantage should be taken of the clever and attractive display ideas furnished by the Society for Electrical Development and other organizations.

By keeping in constant touch with manufacturers and societies and watching the electrical magazines, ideas can be obtained to make weekly changes in the window display easily possible. For this it will be necessary to invest a nominal sum in window fixtures and make a particular study of window lighting. The company's show-windows should set the standard for the community.

Important Contracts Secured for Central-Station Power Service in Minneapolis.

The Minneapolis division of the Northern States Power Company has accepted an additional power contract from the Minneapolis Steel & Machinery Company amounting to 6500 horsepower during the continuance of the war. The latter company is operating a large part of its plant at the present time on a 24-hour-a-day basis. The Power Company has been supplying 2500 horsepower to the Machinery Company, and the additional contract will bring the total demand from this one factory to 9000 horsepower.

The sales department of the Minneapolis General Electric Company during the week ended October 19 secured 519 new electric light and power customers with 261 kilowatts of lighting and 382 horsepower in motors, which includes contracts with the Moline Plow Company for 200 horsepower, replacing a steam plant, and with the Brooks Elevator Company for 40 horsepower in motors. Contracts were taken for wiring 36 already built houses. New business connected to the company's lines includes 222 customers with 161 kilowatts of lighting and 144 horsepower in motors. The electrical energy output shows a gain of 12.7 per cent over the corresponding period a year ago.

Commonwealth Edison Company Has Attractive Exhibit of Household Utilities at Coliseum.

A feature of the Home Exposition held in the Coliseum, Chicago, was the exhibit of the Commonwealth Edison Company, which occupied the northern portion of that spacious hall. The space utilized was subdivided into five sections, within which were the tastefully arranged displays of electrical devices and appliances designed for household uses, economies and betterments.

The conspicuous electric sign, "Edison Service," stretched across the hall, above the exhibit, and emblazoned an idea as well as a commercial insignia; below this was the slogan, "Lighten the Labor of the Home," and the entire exhibit was replete with demonstrations as to how this worthy purpose may be accomplished.

The displays of labor-saving machines, equipment and devices were of a kind that not only lighten the household burdens, but some of them illuminate and beautify the home scene. Among the things exhibited were electric washing machines and ironers, heating radiators and cooking ranges; portable floor, desk and bracket lamps, of designs to suit tastes and requirements; electric vacuum cleaners, vibrators, curling irons, sewing machines, kitchen power units for all utilities, and many other appliances. The uses of all

View of Commonwealth Edison Exhibit at Chicago Home Exposition.

such devices were explained to visitors by all attendants. Especially was electric cooking demonstrated by skillful women who also distributed samples of the electrically-cooked foods. In other places were display counters over which sales of devices and appliances were made.

Centrally situated as to this large exhibit was a reception room for visitors, having been artistically furnished with rugs, chairs, lounges and other conveniences. Flag decorations, comprising the ensigns of the United States and the other nations with which she is allied, adorned the rear wall. Translucent panels marked the front border line of the exhibit, through which concealed lights cast a soft glow, producing the effects of light from the setting sun.

The plans of the exhibit were those of Dana H. Howard, superintendent of advertising, assisted by Harry H. Forner. Hornbeck & Robinson of the Electric Shop produced the decorations. The exhibit was in charge of Arthur M. Lloyd.

Fir Timber for Aircraft Ordered by the Government.

The United States Government has called on the West Coast Lumbermen's Association for 10,000,000 feet of fir for aircraft construction. Of this, 9,000,000 must be free from knots on all four sides, and the remainder must not have more than one knot in each piece. This order puts the Washington mills to one of the most severe tests ever imposed upon operators anywhere, and would probably not be accepted if originating from private sources. Seattle millmen, however, state that the order will be filled within Uncle Sam's own time and at his own price. This order will mean a large supply of culls on hand after the knotless timber has been segregated for Govern-

ment use. The left-over stock will be available for many other purposes. The cutting and sawing of this aircraft timber at Government factories will bring into use hundreds of electrically driven saws and turning machines. Quite a number of the lumber mills of Washington and Oregon use electric power, notwithstanding the fact that mill refuse for fuel is abundant for steam power.

Electric Ovens in Motor Assembling Plant.

Two electrical enameling ovens just installed in the new $400,000 Maxwell assembling plant in Kansas City are among the innovations in automobile assembly. Including the motors and carrying tracks, the ovens cost $10,000 each and will shorten the time of enameling automobile parts from four hours to forty minutes for each coat of enamel. The tracks and ovens are so arranged that the second coat of enamel can be baking in one oven while the first coat is being hardened in the other.

The oven and attachments comprise a movable hanging rack upon which the parts are suspended after being dipped in an enamel vat at one end of the first oven, and a bed of electric heaters in the oven generating 750 degrees of heat. When the enamel dripping ceases the carrier is moved into the first oven and the doors closed. After forty minutes the rack is removed at the opposite end of the oven, the parts dipped in a second vat and moved into the second oven while other parts are being given their first coat.

A thermostat makes the electric heaters automatic by means of improved switches.

New Motor Application in Paint Shop.

The speed and reliability of electricity has found another use in industries in a machine recently designed by Fred G. Vosler, superintendent of assembly for the Maxwell Motor Company in the new Maxwell assembling plant in Kansas City. The machine which will enable one man to paint from 1000 to 1200 automobile wheels in a day, uses an electric motor to rotate the wheel rapidly until it whirls off the surplus paint before being removed from the painting vat. The motor is located on the top of the machine and is controlled by a safety switch at the operator's hand. The electric motor proves elastic enough to give the wheel brisk power from a stand still, then the power is cut off and the momentum of the wheel carries the speed until a brake is applied to it. One great advantage of this power is that the motor is out of the way and no power pulleys, cables or wires interfere with the passage of workmen around the machine.

To secure the volume of work that is demanded of this machine in a day it demands power that is speedy, sure, elastic and safe. An individual electric motor was chosen for these qualities.

Heavy Power and Light Sales at Minneapolis.

Sales Department of The Minneapolis General Electric Company, during the week ended September 14, secured 632 new electric light and power customers, with 357 kilowatts of lighting and 253 horsepower in motors, which includes contract closed with the Minneapolis Manufacturing Company, covering 125 horsepower in motors. Contracts were secured for wiring 42 already-built houses. New lighting business connected to the company's lines amounted to 73 kilowatts. Electric energy output shows an increase of 13.5 per cent. over the corresponding period of last year. Federal bank call of September 11 shows that Minneapolis banks have on deposit $179,269,411, which is an increase of $6,582,949 over bank call of June 20.

Municipal Plant Raises Rates.

The City Council, of Owensboro, Ky., has increased the electric lighting rate on an average of a cent and two-thirds per kilowatt-hour, effective on November 1. As previously stated by the city officials, the municipal plant would no longer be able to furnish service on the old basis, with costs mounting as has been the case. The minimum meter rental has been placed at $1 a month, subject to a one-third discount, and all rates increased from 7½ to 10 cents per kilowatt-hour, with a minimum 33⅓ per cent discount, increasing when large consumption rules. New equipment for the municipal plant, purchased at an outlay of $40,000, is arriving and will be installed immediately.

Wage Controversy on Kansas City Railway Lines.—One week after the Kansas City Railways Company had announced an increase of three cents an hour for its trainmen the newly organized union presented formal demands to the company asking for a much larger boost in wages. The new scale, which was announced October 15 to take effect October 1, retroactively, is 25 cents for beginners and 33 cents after the fifth year. The company took up the demands of the union October 22. They are for a sliding scale of 35 cents for beginners and 45 cents after the third year. Conference with a committee of employes will be held and if no agreement is reached the question will be put to arbitration in compliance with the recent agreement which ended the street-car strike. The company also announced a wage increase of 2 cents an hour for electrical workers and 3 cents an hour for shopmen, barnmen and mechanics. Trackmen probably will receive a raise in salary in the near-future.

Doherty Cadets from 55 Schools.—The cadets in the Doherty organization represent 55 engineering colleges. The 106 cadets now in Doherty service are distributed, according to the schools at which they received their engineering education, as follows: Purdue University, 18; University of Missouri, 16; University of Wisconsin, 16; University of Kansas, 14; University of Colorado, 13; Kansas State Agricultural College, 11; Georgia School of Technology, 10; Pennsylvania State College, 10. Another interesting fact concerning the cadet schools which was recently announced by R. G. Griswold, chief technologist of the Doherty organization, is that 81 per cent of the cadets who have come into the organization are still in it. That is to say, since the schools were organized as now constituted in 1906, the organization has hired 375 men, of whom 305 are still in some part of the organization or have left it recently to join the Army or Navy.

Galena Central Station Establishes New Output Record.—During the week ended October 20 the Interstate Light & Power Company (Galena, Ill., Division of the Northern States Power Company) reached its largest single day's output of electrical energy, amounting to 116,000 kilowatt-hours.

Notes on Operating Practice

A Department Devoted to Practical Problems of Plant and Operating Practice With Particular Reference to Electrical Generation and Distribution

TREATING BOILER SCALE WITH GRAPHITE.

A Discussion of the Various Methods for Eliminating Boiler Scale With Special Reference to the Use of Graphite.

By Lionel Linnell.

Every boiler scales to some extent. Some engineers treat the water before it enters the boiler, and thereafter treat the make-up water. Others treat the water in the boiler. The best results are obtained by following the former practice, since the boiler can then be used most efficiently for making steam, and the water-purifying apparatus for purifying water. The problem is that of water treatment. But there is another problem, namely, that of scale treatment. Every boiler scales, even where the water is previously treated chemically to prevent the formation of scale. This scale gradually covers the metallic surfaces of the boiler, interfering with the transfer of heat from the furnace gases to the water, and, more important still, may cause excessive local heating of the boiler heating surfaces, resulting in warping, cracking, and "bags." The treatment of water for scale is entirely a chemical one, except insofar as the water is also filtered for the retention of solid particles, whereas the treatment of boiler scale may be a chemical or a mechanical procedure, the endeavor in the latter case being to make the boiler surfaces in such condition as to not readily allow scale to adhere to them, and at the same time make the scale into a condition that enables it to be readily removed.

With all the attention now being given matters connected with fuel economy and steam-making every engineer turns his attention toward economizing coal and money by following those practices that work toward that end. First he attempts to execute those economies that are simplest and can be brought about without the expenditure of additional capital and labor. The treatment of scale is one of these. The extent to which scale reduces the efficiency of a boiler—a thermometer in the stack to indicate the temperature of the furnace gases after they have passed through the boiler heating surfaces gives some indication of the boiler surfaces inside and outside as well as improper furnace efficiencies—varies upon the thickness and form of scale, and though perhaps not as great as often supposed, still may be anywhere from a few to 20 per cent. The man who pays for coal, whether he purifies his water or not, may therefore feel justified in taking steps to prevent scale formation in his boilers, and at the same time treat it in such way that it can be removed easily without excessive vibration to the tubes, etc., and in the shortest time, and with least effort.

Scale forms of varying characteristics depending upon its constituents. Sulphate of lime, carbonate of lime and magnesia are the most frequent constituents, whilst sulphate of magnesia and chloride of magnesia also occur often, these latter being corrosive in action upon the boiler heating surfaces. Some scales form with a hard stony scale, very difficult to remove, others are porous and soft, although the high heat may bake them hard. Scale has a tendency to form most rapidly where the temperature is highest, which is where the presence of scale is most injurious, where the evaporation is most rapid, and will deposit more quickly with sluggish than with rapid water circulation. Scale that is allowed to exist may accumulate in the upper portions of a boiler and finally fall down upon the lower portions, thus causing damaged heating surfaces, expense for repairs and possibly accidents. The remedy is therefore to treat boiler scale that the efficiency of the boiler may be maintained as high as possible, and that the boiler itself may be protected against damage.

There are numerous old-time remedies for treating boiler scale—not treating the water to prevent scale—some of which are effective and possess no objections to their use, whilst others are practically worthless as well as offering several serious objections. For example, potatoes and glucose are sometimes boiled up in the boiler in the belief that they cause a slimy surface to form inside the boiler and upon the scale particles. Molasses is used for the same reason, but these substances are liable to cause foaming in the boiler, will in any case cause the formation of organic acids to attack the boiler metal and may clog up valves, etc. There are, however, two substances which can be used with good success in the prevention of scale from adhering tenaciously upon boiler surfaces and to make the scale easily removable if used judiciously. Both act mechanically by covering the boiler surfaces with a grease-like coating upon which scale particles cannot readily adhere, and also affect the form of scale. One of these is flake graphite, the other kerosene. Only graphite will be discussed here.

Graphite for Scale Treatment.

In the majority of cases graphite is very effective for the treatment of scale—not preventing it but treating it—since it mingles intimately with the scale in the making, thus coating it and combining with it. The metallic surfaces of the boiler likewise become coated, and thus the scale tends to slide over them instead of adhering and becoming incrusted and burnt in. Graphite does not prevent scale, but it does change its condition, making it soft and crumbly, and thereby more easily removed.

Flake graphite and not the amorphous should be preferably used, as the former appears to spread more smoothly and quicker than the latter over the boiler surfaces, thus working more effectively and efficiently, thus requiring less for a given amount of water.

Feeding Graphite to the Boiler.

The question as to how much graphite to feed to a boiler is one that can be settled only by experience, depending upon the scale-forming properties of the water and rates of steaming and water circulation. In any case it is decided by trial. Usually the amount of graphite necessary for 24 hours is made up into a paste with hot water. The graphite is then placed in a container which in turn is connected to the suction pipe of the boiler-feed pump. The graphite may be fed into the boiler with the feed-water by periodic hand control, as is done with certain types of lubricants for lubricating purposes, or it may be fed in automatically by the feed pump, the rate at which it is fed into the boiler depending upon how wide open is the check valve controlling the graphite. Experience soon tells the rapidity with which graphite is consumed, and to accomplish this a sight glass between the stored graphite and the inlet to the suction of the feed-water pump will be found very convenient. While the amount of graphite required daily depends upon the scale-forming properties of the water, and characteristics of the boiler, it is probably safe to say that for average conditions from 1.5 to 2 pounds of flake graphite per 24 hours suffices for a 500-horsepower boiler, with proportionate amounts for smaller units.

Once it has been decided to use graphite for scale treatment perhaps the following procedure leads to best results, although the treatment should be continued for about one month before deciding upon the results, since graphite works slowly but surely. Some time before shutting down the boiler for scale removal treat with graphite, as this works in under existing scale and works it loose. After the surfaces have been scraped and washed out during the scale removal and the boiler is ready again for service, feed in about the normal twenty-four hour supply at once, as this spreads rapidly over the clean boiler surfaces, coating them with a thin film of graphite to which scale cannot adhere when it forms again. Thereafter feed in the normal amount little by little. After first commencing the use of graphite it is important to examine the boiler more frequently as the scale that has worked loose may fall and form a hard caked accumulation which damages the surfaces by overheating. After the scale existing before the treatment has all worked loose and been removed less frequent inspection is required. Once the old scale has been removed, if an excess is not used, and if the flake and not the amorphous graphite is employed with ordinary care, sludge and dangers will be obviated. Less graphite is needed as time goes on, and if the surfaces are treated generously after each cleaning out.

Graphite may be used for scale treatment with good results without knowing the chemical composition of the scale, as is necessary where chemical treatment is resorted to. The only precautions necessary are not to use too much and to remove loosened scale as it occurs. The argument so often advanced that the graphite film upon the surfaces of the boiler may cause overheating is in error as graphite is a very good conductor of heat and scale is a very bad one. Care should, however, be taken not to allow oil to be mixed with the graphite. Oil is not miscible with water, hence graphite mixed with oil defeats the purpose of the graphite, namely, to mix with the scale particles.

Use of Flake Graphite.

If used judiciously flake graphite is very effective for the treatment of boiler scale by making it slippery and crumbly instead of hard. It also keeps the boiler surfaces slippery, to which the slippery scale cannot readily adhere. The dangers to the boiler due to hard scale can therefore be largely prevented; the loss of heat transmission due to scale is prevented, and the work required to clean a boiler is made much easier and less injurious to the boiler, since the scale and sludge can be removed by washing and scraping instead of chipping, with the accompanying injurious vibration that may cause fatigue and rupture of tubes, etc. The use of graphite is one of those practices that the small plant can follow that makes for economy of operation as well as the fuel bill.

The Value of Modern Blowers.

By W. F. Schaphorst.

Power-plant operators may not know that blowers are coming into more general use in the boiler room, as an important economy factor. Blowers are not highly economical in the use of steam, true enough, because no small turbine, built inexpensively, is highly efficient. But blowers are economical, because they can be made to save the installation of an entire boiler, or the erection of a new and expensive chimney. They are used for creating more intense drafts and at the same time for increasing the steaming capacity of the boilers. A new blower, of course, doesn't cost as much as a new boiler. In fact, it doesn't cost nearly so much. And it is the interest on the difference of cost of the entire change as it is and as it would have been that decides in favor of the blower. In some cases, in actual practice, the steaming capacity of the boiler has been doubled, and even more than doubled by the installation of a good blower.

Where a new plant is being built or is to be built, it is plain, then, that a simple little blower may affect the ultimate design considerably. The large chimney is not needed at all. Just install a pipe large enough and high enough to carry the smoke and gases up out of the danger zone, and that is enough.

Install several blowers—one with each boiler—and only ten boilers need be installed, whereas twenty might be needed otherwise. Another saving soon makes itself evident in the quality of fuel that may be burned. A blower will force air through cheap coal, whereas with natural draft, the combustion of the more expensive and high-grade coals is an absolute necessity in most cases.

To be sure, the installation of a blower must not be made "off hand," without consulting the manufacturer's engineers. And don't write to one manufacturer only. Write to several, and get the combined opinion of them all before taking any step. Or, put the matter entirely in the hands of good consulting engineers. If your boiler is now operating at rated capacity only, on natural draft, and you are in need of more power, you may find this step worth your while.

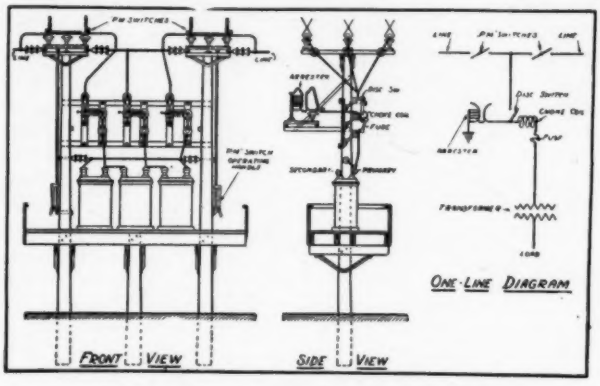
Step-Down Outdoor Substations on Ring Feeder Systems.

By H. W. Young.

The use of high-tension ring-feeder systems has the advantage of increasing the reliability of service, in that during line trouble on one section the load can be supplied from the other section. Ring feeders should be equipped with a type of step-down station, which can quickly be connected to take current from either direction, or if necessary be entirely disconnected without interrupting the main transmission circuit.

These conditions are met by the construction illustrated, the circuit connections being shown in one line diagram. With this method the substation can be entirely isolated by opening the disconnecting switches, the line switches remaining closed and completing the feeder ring. In case of trouble on either section, one line switch can be opened and service secured through the opposite switch. This flexibility of operation is highly desirable.

The main line air-break switches are of the three-pole type equipped with arcing horns to permit opening under load conditions. Each switch is provided with a manually operated, remote-control interlocked mechanism, enabling all three phases to be simultaneously opened or closed. By means of a locking type handle, the switches can be securely locked in either open or closed position. The disconnecting switches are not designed for opening under load but simply to



Substation for Ring Feeder System.

enable isolating the station, when replacing the fuses, adjusting arresters, or working on the transformers.

Lightning protection is secured by means of long-turn powerful choke coils and high-speed sphere-gap graded-resistance lightning arresters. This combination offers a very effective low-cost protection and eliminating the necessity of daily attendance or inspection. The primary carbon-tetrachloride fuses have the desirable characteristics of quick opening and high kilovolt-ampere rupturing capacity. These fuses are of such rating that they will not open under ordinary over-loads, which will be taken care of by the secondary circuit-breaker or fuse. The function of the primary fuse is to instantly open the circuit in case of transformer failure, or short-circuit, thus preventing a local disturbance spreading to the transmission system.

The type of station illustrated can be conveniently used for all voltages up to 33,000 and kilovolt-ampere capacities up to 300. For smaller capacities the middle stub under the platform can be eliminated, although the cost of this is small and its use is desirable if any considerable growth in the kilowatt capacity is expected.

Thawing Out Cables With Hot Water.

By M. S. Montgomery.

During the cold winter months when pulling out cable to replace with new cable, because of faults or other causes, it is not uncommon for the men to find that the cable is immovable on account of being frozen in place tightly by water and mud. That the cable becomes frozen may be due to the fact that the ducts or laterals are improperly drained; on the other hand such freezing will often happen when a rapid drop in temperature occurs after a rain storm following a rise in temperature, the reason being that the subsoil is still frozen up hard and the rain is unable to drain off into the earth.

Usually a cable frozen up in the duct or lateral makes itself known by breaking down under the pressure exerted by the ice, or else is only discovered when effort is made to pull it out, but unsuccessfully. At such times speedy removal is important, for if the

line has not broken down and interfered with service by doing so, the duct is needed for another section of cable, and a number of men are dependent upon the work going along normally. Quick thawing is therefore always desirable, usually very important, and the underground foreman turns his attention to finding the safest and quickest way of thawing out the cable. There may be several ways of thawing; and then again there may be only one way—digging up the ground—depending upon circumstances. Digging is never resorted to unless no other way appears feasible, because it takes time, especially when the earth is frozen hard, causes a large amount of work in the way of taking up and laying down again soil or pavement, etc. Lighting fires beside laterals and above duct lines sometimes accomplishes the purpose, although difficulty of heat control and it being so local in effect makes it a risky practice around laterals, whilst the customary depth of cable ducts makes it of doubtful value in thawing out duct lines. Electrical thawing, long since recognized as so convenient, economical and rapid for water pipes, is likewise applicable for thawing underground cables—in fact it is often the only way to accomplish anything without digging up the ground—but especial precautions must be taken to prevent damage to the cables. There is yet another method of thawing, often used to good advantage, namely, by the use of boiling water.

Thawing Out Cables With Hot Water.

Thawing out ice-bound cables by means of hot water is of course only possible where the water is able to reach the frozen water or mud. It suffices where a cable is frozen in a lateral, anywhere beside the pole to which the lateral is fastened, and to a few feet below the surface of the ground. Beyond it may also thaw, although this can be known only by attempting to do it, when the results or absence of results will indicate whether or not the water is able to trickle through to the frozen mass. Where boiling water is used for thawing below the surface of the ground it should be borne in mind that it may cause trouble later, since the hot water that once thawed out one cable may later become frozen itself, thus doing harm. Perhaps it is best, and safest, to use boiling water only for thawing out laterals, that is cable lengths above ground level.

The use of hot water is not free from danger when poured down the inside of a lateral, to either the cable or the man that is doing the pouring. If the cable enclosed by the lateral is alive, and defective, the hot water may cause a breakdown of insulation, which in turn may cause an action within the lateral similar to an explosion, due to the formation of steam in a restricted space. This danger can be prevented, and without interfering with the effectiveness of this method of thawing, by pouring the water down the outside instead of down the inside of the lateral.

Obtaining water and boiling it may present difficulties, unless special provision is made before hand. The equipment for thawing by hot water is, however, less bulky and much lighter than that needed for electrical thawing. As a frozen lateral is usually unexpected, hence apparatus is not on hand the cable splicers' blow torches are used for the heat and the everyday bucket that goes with the cable splicers' outfit used for the water. Sometimes large quantities of water are needed, and lacking it results in failure to accomplish the thaw. One company actually equipped a one-horse truck with water tank, but it was never used to any extent, opinion favoring electric thawing, since there are so many instances where electricity must be used because the hot water cannot reach the frozen portion of the cable, and much time and delay result in attempt to use water.

Some companies absolutely forbid the use of hot water for thawing out cable or laterals, claiming it to be dangerous practice and one liable to endanger the men doing it. If properly done, as already explained, namely, where the cable is not alive or where the water is poured down the outside of the lateral, there is little risk to the man doing it. There is always a chance of the cable being damaged, however, since it may become impounded and frozen.

Thawing laterals and duct lines with boiling water is a method applicable to small quantities of ice, within easy reach and accessible to the hot water, and may then offer a simple, quick and inexpensive manner of thawing. It is not entirely free from dangers, if not to the men to the cable, and frequently may fail in its purpose. Perhaps time will be saved by using it only when its use is plainly indicated, and not merely on the chance that it might accomplish the end sought.

Electrifying a Large Brewery.

One of the most satisfactory power contracts made for some time by the Metropolitan Edison Company, of Reading, Pa., was closed recently with the Reading Brewing Company. Not only does it mean that the brewing company becomes a larger consumer of power, but that its modern plant is to be completely electrified by an outlay of $10,000 for changes to machinery. This is regarded as a great step forward in the Metropolitan Edison Company's campaign for electrifying the industrial plants of Reading. All of the brewing company's ice and bottling machinery, among the largest of the kind ever built, is to be electrically driven with a 400 horsepower consumption.

The Metropolitan Edison Company is negotiating with several other important industries.

Interconnection of Oregon Power Company's Plants to Promote Operating Economy.

The Oregon Power Company recently completed an extension of its transmission system from Marshfield to Coquille, Ore., which has heretofore been supplied electrically by the company's local steam-electric plant. Arrangements are now being made to extend the company's lines from Coquille to Myrtle Point, another heretofore isolated part of the company's system. These improvements will connect all of the company's operations into one unit and make possible operating economies in which the public will share by means of a rate reduction just announced.

Lays Cable Across Bay to Serve Shipyards.

The Eureka (Cal.) Division of the Western States Gas & Electric Company has completed laying its 11,000-volt cable across Humboldt Bay to supply electricity to shipyards and other industries in that district. The shipyards are exceptionally active now and eight keels for new boats have recently been laid.

Additional Line to Insure Continuity of Service.

To overcome any possibility of interruption to electric service at South St. Paul, Minn., the Northern States Power Company will construct a new high-tension transmission line connecting the St. Paul and South St. Paul distributing systems.

Electrical Construction Notes

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Equipment of a German Military Substation.

By H. J. Wright.

Considering the important part which electrical equipment is playing in the great war, little information is available relating to the type of equipment and circuits being used. A bit of data interesting in this connection is that which may be obtained from a study of a diagram (Fig. 1) of a German military substation at Vimy Ridge, which was captured by the Canadians some time ago. The original diagram from which Fig. 1 was reproduced was attached to the wall of the Vimy Ridge substation at the time of its capture and was secured by R. D. Earle of the 116th Battalion. He mailed the sketch to G. D. Earle of the Earle Electric Company, of Toronto, Can., who in turn submitted it to the Canadian Electrical News, in which the installation was first described.

The sketch, as indicated in the lower right-hand corner, is dated August 7, 1916, and is signed with the name "Matheis." The title, in German, on the sketch, when translated, reads "Central Lighting Plant, Vimy Fort." Reading down on the left, the legends are these: "Knife switches," Oil switches," "Transformers." The vertical legend is "5000 volts high tension." The wording on the circuit to the right is "to battery, Schabian tunnel."

While all of the details of this sketch are not entirely clear, it is probable that the circuits indicated in Fig. 2 show an Americanized version of the original diagram. It appears that the supply feeder to the station is a 5000-volt, three-phase circuit which passes through the lightning arresters *L*, choke coils *C*, disconnecting switches *DS*, and oil switches *OS*, to the high-tension side *T*, of the three-phase, star-connected step-down transformer. The low-tension circuits feed two distinct systems. One of them is a three-phase, four-wire system which is doubtless used for incandescent electric lighting at locations not far distant from the substation. The other system, which is supplied from a motor-generator, is 220-volt, direct-current, and is probably used for storage-battery charging or some other similar service.

It is likely that Mr. Matheis was somewhat mixed when he specified on his diagram (Fig. 1) 110 volts on the two-wire single-phase branch incandescent lighting circuits and 220 volts on the three-phase circuit from which they are tapped. This being a three-phase circuit, if the voltage on the branches was 110—that is, 110 volts to neutral—the voltage between each of the three phase wires would be 192, as specified

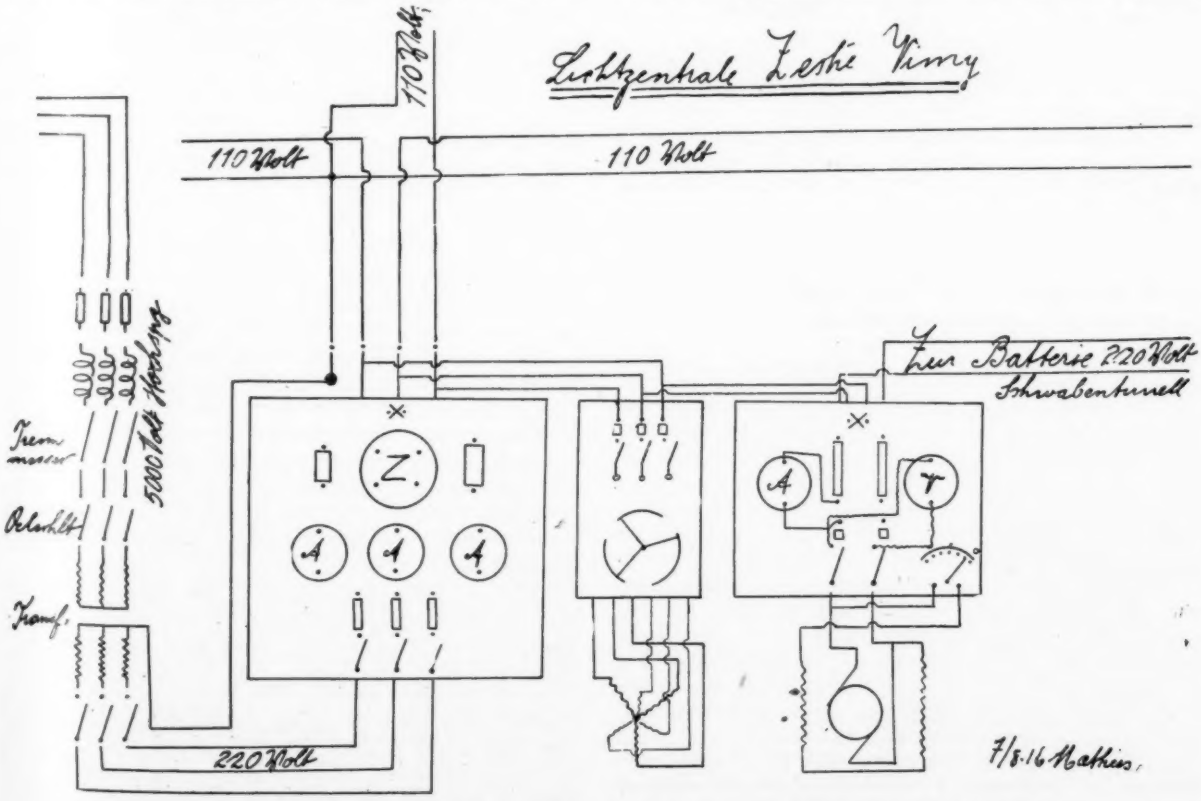


Fig. 1.—Diagram (Drawn by a German Soldier) of a Military Substation at Vimy Ridge.

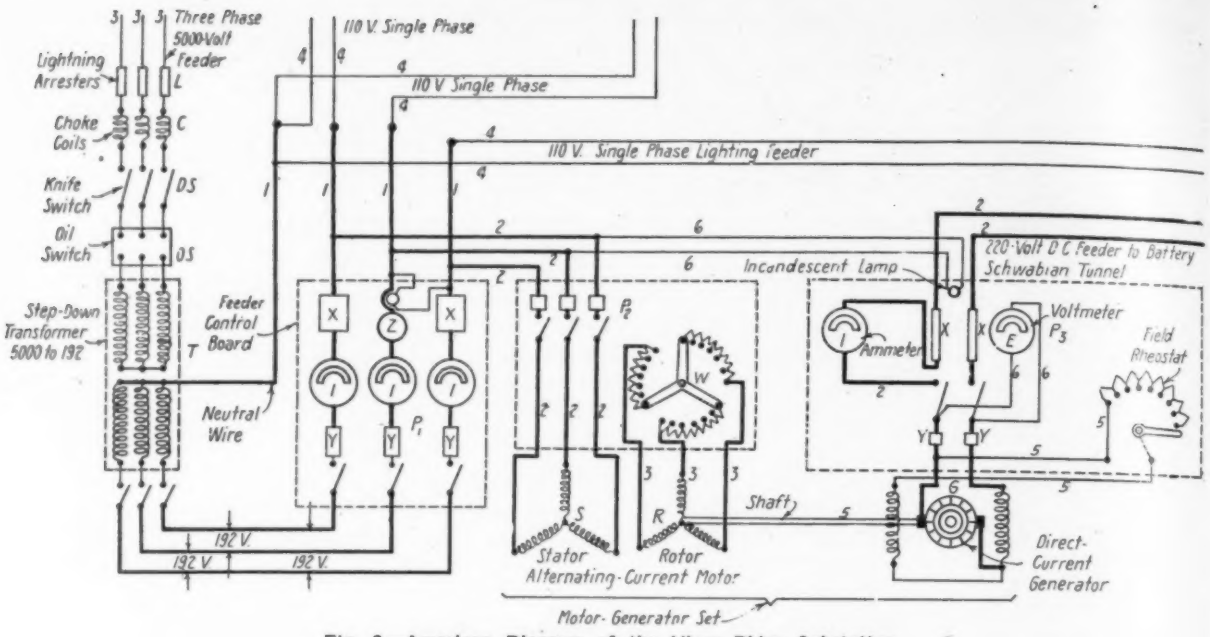


Fig. 2.—American Diagram of the Vimy Ridge Substation.

in the lower left-hand corner of Fig. 2. P_1 seems to be a control panel for the entire substation. It is assumed that X and X are circuit-breakers and Y and Y are fuses. Z is probably a wattmeter. The panel P_2 is for the control of the 192-volt, wound-rotor, alternating-current induction motor of the motor-generator set. S is the Y-connected stator winding and R is the rotor winding. W is the external secondary rheostat for starting the motor. Panel P_3 is for the control of the 220-volt, compound-wound, direct-current generator G, which supplies direct-current energy. There seems to be an error in the connection diagram of this generator as it is given in the original sketch (Fig. 1). The two devices marked X and X, at the tops of the two outside panels in Fig. 1, are probably incandescent lamps for lighting the panels and have been so shown in Fig. 2.

Considered as a whole, the installation appears to be complete and carefully designed and is an indication of the thoroughness with which the Germans started in on their would-be job of conquering the world.

Combined Intercommunicating and Central Telephone Connection.

By David R. Shearer.

The accompanying sketch illustrates the use of two or three telephones on a common-battery exchange for intercommunicating private use. By this means two or three telephones may be connected on the same line leading to the exchange and yet be used with each other without calling the central.

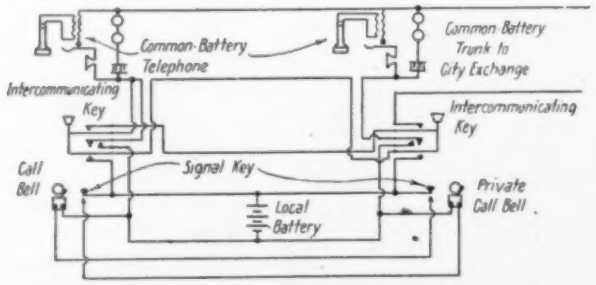


Diagram of Connections of Combined Central and Intercommunicating Telephone Installation.

This system is of especial benefit in an office or other place requiring more than one telephone but not a sufficient number to warrant the installation of a private-branch exchange or intercommunicating-trunk system. It is intended for two or three telephones only.

Either of the instruments may be used to call central, or either, by the depression of a key, may call the other without ringing the central. It is necessary to hold down the key while conversing with the other telephone, as releasing the key re-establishes the trunk connection.

From the diagram it is evident that when either intercommunicating key is depressed the trunk connection is broken and the local battery is cut into circuit. Local calls are made by a separate signal push-button or key system.

Among the Contractors.

George W. Kemper, of Minot, N. D., has received the contract for installing an electric lighting system at Malta, Mont., the contract price being $39,000.

The Sterling Electric Company, 33 Fifth Street South, Minneapolis, Minn., has the contract for furnishing and installing an electrical distribution system at Rice, Minn. The contract price is $7995.

NePage, McKenny & Company, electrical engineers and contractors, Armour Building, Seattle, Wash., have the contract for the complete electrical equipment in the School for the Blind being erected by the State at Vancouver, Wash.

Electrical Service Company has entered the general electric service business at 412 Third Avenue, East, Cedar Rapids, Ia. The new organization is composed of C. E. Rowe, who has been engaged in general electrical work for the last 20 years, and R. E. Foster, who has been doing electrical laboratory work for some time. They are authorized agents for the U. S. L. batteries, Affinity spark plugs, and will engage in the sale and repair of electrical equipment.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 403.—Signal Circuits Run over Roof Tops of Buildings.—In quite a few large cities it has been a custom to run telephone and telegraph wires and cables from one building to another over roof tops and across streets and alleys more or less indiscriminately. Are such circuits run with consent of the insurance interests? Is it necessary to secure special city permits or are the cables installed without securing any permit whatsoever? Have such cables been found a hindrance by firemen? Is there anything in the National Electrical Code covering them? In what cities, if any, are they positively prohibited?—C. E. M., Springfield, Ill.

No. 404.—Protecting Railway Storage Batteries.—In installing a large railway battery, what are the special precautions to be taken to prevent explosions? Also, how can the corrosive fumes from the battery room be prevented from attacking neighboring objects?—C. D., Milwaukee, Wis.

No. 405.—Construction of Four-Way Switches.—I would like some of your readers to furnish a sketch of the actual construction of a four-way switch, such as is used in conjunction with three-way switches for controlling lamps from several points. In the Electrical Review and Western Electrician of March 17, 1917, page 455, there are several clear sketches of such systems, but I do not understand the construction of the switch itself and how it opens and closes the circuit.—V. J. L. N., New York City.

No. 406.—Small Central-Station Ice Plants.—Under what circumstances would the small central-station company be justified in going into the ice-making business? What are the factors involved?—E. G. R., Chicago, Ill.

No. 407.—Magnetic Brake.—The coils on a magnetic brake for an Otis elevator give trouble by burning out frequently. Each segment has 143 turns of No. 11 wire and two segments are connected in series across 240 volts. I would like suggestions for rewinding the coils to eliminate the trouble without changing the magnetic pull.—S. A. B., Reno, Nev.

Answers.

No. 398.—Iron-Wire Lines.—On account of the high cost of copper it has been proposed to use iron wire more freely for rural light and power lines. What is the general experience with iron wire for this purpose? What kind and size of wire is most used? What is the maximum economical distance that a single-phase load of five kilowatts can be transmitted with iron wire at 2300 volts? Is the upkeep very expensive? I will greatly appreciate any information on this subject.—H. S. C., Washington, D. C.

The steel conductors which have probably been most commonly used for branch-line distribution are No. 4 (approximately 0.23 inch in diameter) and No. 6 (approximately 0.20 inch) solid wire of comparatively high purity. A conductor which may be preferable to the above for 60-cycle current is 5/16-inch ordinary steel cable, such as is used for guys, etc., in pole-line work. This has less skin effect, that is, ratio of alternating-current resistance to direct-current resistance, partly because the lower grade of steel has less permeability to magnetism, and partly because a stranded steel cable has inherently less skin effect than a solid steel wire of the same cross section. The greater part of the skin effect is due to magnetic flux inside the individual wires, as this flux has an uninterrupted iron path and does not have to cross any air gaps. It has been found by experiment that small wires, and cables made up of small wires, have much less skin effect than large steel wires. The length of life of galvanized steel wires and cables is of course not so long as that of copper conductors, especially near the sea coast or in large cities. But the use of steel cables as ground conductors on transmission lines is very common, and reasonably long life is obtained. Assuming that 5/16-inch stranded steel cable is used to transmit a single-phase load of 5 kilovolt-ampere at 2300 volts, 90 per cent power-factor, the resistance will be approximately 6 ohms per mile of cable and the reactance will be about 2 ohms per mile, at the current considered. The voltage drop will therefore be approximately 5 per cent when the distance transmitted is 4 miles. It is advisable to measure the alternating-current resistance of a sample of the steel conductor intended to be used, as there are considerable variations between different grades.—H. B. D., Hamilton, Ont., Canada.

No. 401.—Transformer for Low Secondary Voltage.—Will some one kindly give in detail suggestions for building a transformer to be used on a 440-volt, 50-cycle, three-phase circuit to give 6 to 10 volts single-phase secondary, the capacity of the secondary to be from 1800 to 2500 amperes? It is to be used for supplying current to an arc for cutting cast-iron and steel plates, engine heads, etc. Would a higher voltage on the secondary be an advantage? The average thickness of cast iron to be cut is 1¼ inches; the average steel thickness is ⅞ inch. Occasionally as large an object as a solid shaft 6 inches in diameter must be cut. The transformer must be portable or semi-portable. Would oil or air cooling be better? I would like as complete details of the core construction and winding as possible.—J. B. K., Torrance, Cal.

The only transforming device that will give satisfactory results in welding and cutting is a rotary converter or a motor-generator set giving direct current at 60 to 30 volts and amperage dependent on the size of the work to be done. Cutting is best done with a carbon arc using the metal as the positive and the greater the available amperage the greater will be the speed of the work. Two hundred amperes is a small capacity and 400 and over is to be preferred. A machine with a drooping characteristic is to be preferred, the starting voltage being at 70 to 80 and dropping with load so that it is about 20 to 30 at the rated full current. Welding is done with either a metallic or a carbon electrode and the currents range from 100 amperes up.—W. M. P., Seattle, Wash.

No. 402.—Economizers and Motor Auxiliaries in Small Boiler Plants.—Is it considered good practice to install economizers in the smoke flues of a small boiler plant, say, one consisting of two 350-horsepower water-tube boilers operating at 185 pounds pressure and supplying a 1000 and a 500-kilowatt turbogenerator? Would it be better to use economizers and operate the condenser auxiliaries and other pumps with motors, or use the exhaust from steam-driven auxiliaries for feed-water heating without economizers?—T. M. W., St. Paul, Minn.

The writer presumes that the plant is to be located in the district from which the inquirer writes, also that the plant has a fairly good load-factor, and that the boilers are stoker-fired. In this case I would consider an economizer a really good investment. With turbine units and motor-driven auxiliaries the feed water would be free from oil otherwise present from cylinder lubrication of several steam-driven auxiliaries. This is an important factor. Small turbines for driving condenser auxiliaries of this size units are not advisable. If the boilers are hand-fired and plant has a low load-factor, the investment in an economizer would be questionable or if the plant is already in operation and necessitates considerable remodeling to adopt the economizer the investment again is questionable or most likely unprofitable.—J. F. F., Toledo,

[Also see article on this subject by I. L. Kentish-Rankin in Electrical Review of September 29, 1917.]

Electrical and Power Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

High-Voltage Downward-Opening Disconnecting Switch for Restricted Quarters.

The ordinary high-voltage knife-blade disconnecting switch is operated by a hook on the end of a long rod. This necessitates a certain amount of space for the operator directly below the switch and perpendicular to its base, which depends both upon the length of the blade and of the rod used to open and close the switch.

In some plants the space on which the operator would have to stand to use the switch hook at the considerable angle required is so small in relation to the height of the disconnecting switch that the usual design is practically prohibitive.

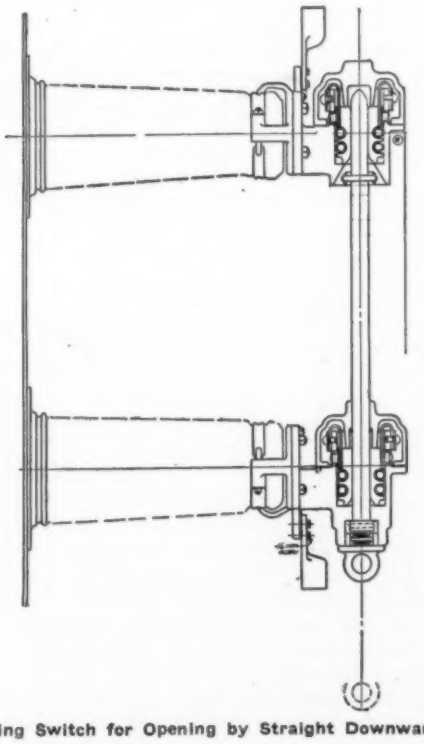
In several such cases the switch illustrated herewith led the way out of this difficulty. It is operated from directly below by pulling straight down with a disconnecting switch hook.

The insulators, insulator caps, and terminals are standard. The blade is a copper rod with a cast eye fastened on one end and a readily renewable solid brass contact tip on the other. The stationary contacts are the same as those used on General Electric motor-operated or type H oil circuit-breakers.

When the switch is opened a flange near the tip of the rod-like blade prevents the blade from dropping below the upper part of the lower stationary contact. A wide flare on the lower end of the upper contact leads the blade into place when the switch is being closed.

After the blade is closed, a slight turn to the right or left by the operating rod locks the blade in position and prevents it from opening except when desired.

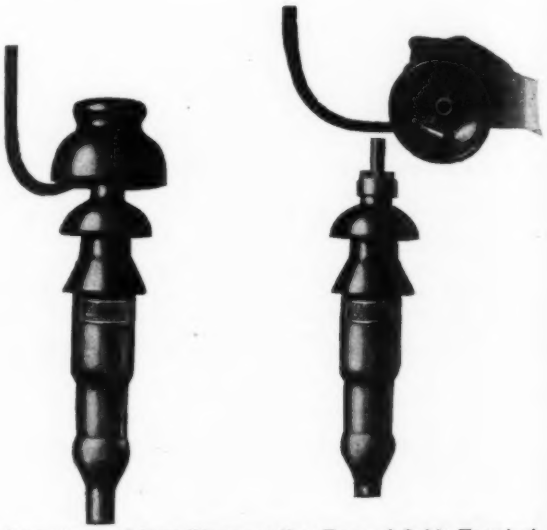
This switch is made by the General Electric Company, Schenectady, N. Y.



Disconnecting Switch for Opening by Straight Downward Pull.

New Type of Cable Terminal.

A new style of outdoor (type D. O. A.) cable terminal has recently been placed on the market by the Standard Underground Cable Company, Pittsburgh, Pa. It is known as the protected disconnection style.



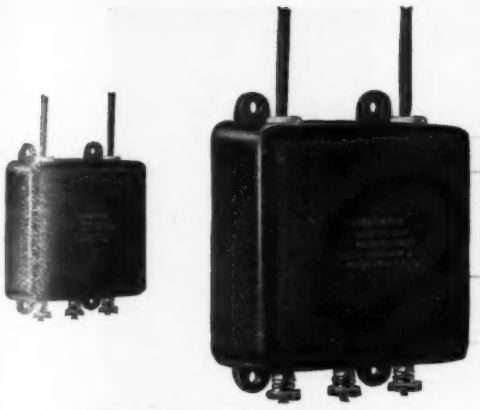
Two Views of New Disconnecting Type of Cable Terminal.

All the copper parts are covered by a porcelain hood, as shown in the illustration, which permits the disconnection of the aerial extension wire even while the circuit is alive.

All the outdoor cable terminals made by the Standard company are readily disconnected from the aerial conductor either by means of a set-screw, cap-nut or turnbuckle stem. The stem of the new terminal is a modification of the regular cap-nut stem and has some additional advantages where frequent disconnection ot the aerial circuit from the terminal is necessary. The new terminal, as well as the complete line of Standard outdoor cable terminals, is fully described in the company's bulletin No. 700-2, which has just been published and is now ready for distribution.

New Rittenhouse Bell-Ringing Transformers.

In large installations, such as apartment buildings, hospitals, schools and the like, it is very much more economical to operate bells and others signaling



Ritco Bell-Ringing Transformers.

devices by means of low-voltage transformers, supplied from the standard lighting circuits, than it is to operate same with the more common dry cells. The economy, as well as the convenience and reliability of this method of operation, is becoming so thoroughly appreciated that the demand for high-grade bell-ringing transformers is steadily increasing.

To meet this need the A. E. Rittenhouse Company, Honeoye Falls, N. Y., has placed on the market two new types of what is known as the "Ritco" bell ringer. Two sizes of these are shown herewith. The smaller one has a capacity of 20 watts and provides three secondary voltages, 6, 8 and 14 volts. The larger size has a capacity of 30 watts and provides secondary voltages of 8, 16 and 24 volts. In each case the primary can be furnished for either 110 or 220 volts. The inclosing case is made of substantial pressed steel. Each transformer is given an insulation test of 2500 volts between primary and secondary coils; also between the coils and the case. The winding is so designed that it will not burn out or be seriously damaged if the secondary is short circuited continuously. The standard frequency for which these transformers are made is 60 cycles. Each transformer is thoroughly guaranteed.

Model Motion-Picture Studio.

This model of a motion-picture studio represents a composite design of the best that applies to the construction and equipment of such a building. The Cooper Hewitt Electric Company built it and exhibited it for the first time at the recent New York Electrical Show.

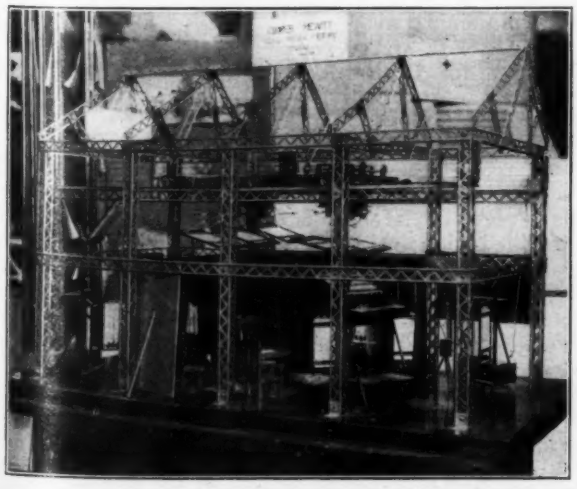


Exhibit Model of a Well Lighted Movie Studio.

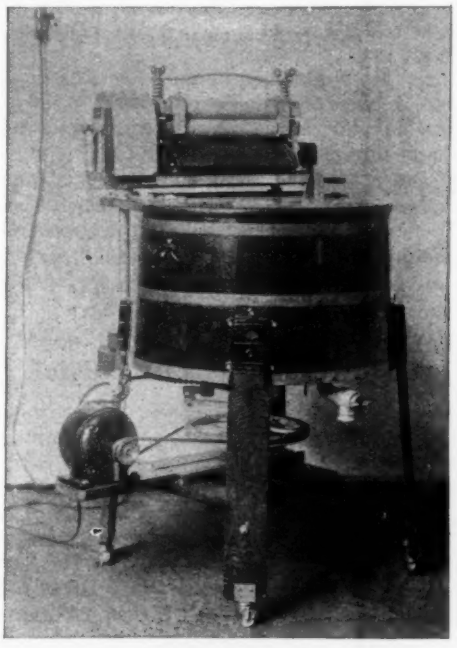
William A. D. Evans, assistant to the vice-president of the company, explained it to hundreds of visitors who had never had the opportunity to see a real movie studio.

The structure of the model is of Erector steel, built much like a factory building. Overhead there are two electric cranes which can travel the full length of the building and these carry transverse cranes. From these latter are suspended the Cooper Hewitt lamp units, technically called skylights. Placed around on the floor are other portable units, called floor stands, which can be moved around to suit and in conjunction with the skylights throw the intense actinic light required for all parts of the set.

A complete, illustrated description of a modern studio equipped in this manner was published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of January 6, 1917.

The "Model" Electric Home Washer.

A washing machine which possesses several features of merit is that made by the Miller Manufacturing Company, Meyersdale, Pa. In its design the aim has been to make a machine which will wash and wring the clothes effectively and yet be sold at a reasonable price. To achieve the latter end, simplicity has been the keynote throughout.



"Model" Electric Washing Machine.

Cypress wood is used in the tub, which is corrugated inside by grooves cut in the wood. It is held together by three hoops of galvanized steel and has a drain-spigot in its bottom. On a platform below is mounted a Westinghouse one-sixth-horsepower splash-proof motor, which can be supplied for direct current or alternating current. This is belted to a flywheel to which is geared the rocker shaft. This is of square section so that it can move to accommodate a varying quantity of clothes in the tub.

The important feature of a washer is the agitator which imparts motion to the clothes and water. In

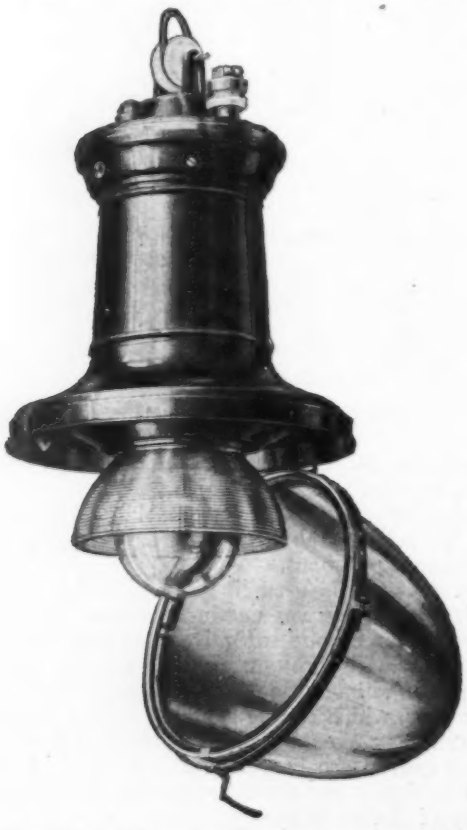
the Miller washer, this is a disk of wood about three-quarters the diameter of the tub. To the lower surface are fastened six cleats two inches deep. These take firm hold on the clothes, while they will not catch in such a way to tear them. The weight of the rocker shaft and dasher is not great enough to pack the clothes down and prevent the water from circulating freely as the mass is worked back and forth against the corrugated sides and bottom of the tub.

Two types of wringer are furnished, one having a safety quick-release feature, the other without it. In either case, the direction of rotation of the wringer is controlled by a convenient lever so that the clothes can be wrung in either direction. Two forms of drive are furnished, in one of which the motor is belted to the gear mechanism on top of the cover.

Another model, known as Type A, has all the driving gears underneath the tub. Thus the top is kept clear of all machinery. The 10-inch wringer is driven by a vertical shaft, and as it can be run simultaneously with the washer, one batch of clothes can be wrung while the next is being washed. In this case, the wringer can be swung entirely clear of the tub, a feature which is much appreciated when opening the latter for inserting clothes or cleaning.

New Stippled Globes and Refractor for Novalux Street-Lighting Fixture.

A new glass globe, and an improved Holophane refractor, have recently been added to the General Electric Novalux street-lighting fixture. The new Holophane dome refractor, made of prismatic glass, collects more upward light than other designs and throws this light sideways and out into the street, at an angle of ten degrees below the horizontal. It practically does away with a reflector, and makes the lamp far more efficient.



Novalux Fixture with New Dome Refractor and Stippled Outer Globe.

Novalux Ornamental Fixture with Eight-Paneled Stippled Globe and Refractor and Reflector.

The new glass globe, also added to this Novalux fixture, is of clear glass, stippled on the inside. It diffuses the light over a large area and at the same time absorbs very little more light than a clear globe. The globe also eliminates any dazzling point of light, producing a glowing effect that spreads a flood of light evenly over the street.

The General Electric Company's new Novalux fixture, as shown herewith, with the stippled globe and dome refractor takes the gas-filled Type C Mazda lamps in all sizes from 250 to 1000 candlepower.

Specially designed for residential and park-lighting service, a new ornamental Novalux fixture has been announced by the General Electric Company having an eight-paneled outer globe of stippled glass and equipped with a new refractor and reflector.

The lamp interior has two important improvements. The new bell-shaped Holophane refractor collects all the upward light and redirects it at the most efficient angle. A cone-shaped reflector at the bottom saves the downward rays, otherwise lost, and transmits them to the street.

The eight sections of the outer globe are all of stippled glass designed to diffuse the light efficiently over the greatest possible area and to give the lamp a luminous glow which makes it specially ornamental, even in the daytime.

Fittings for Convenient Installation of Electrical Circuits in Large Mills.

The extraordinary industrial development of recent years has brought about the electrification of numberless large factories and mills. In such establishments the larger buildings are almost invariably provided with steel trussed roofs and girders or beams for floor supports. The wiring in a plant of this kind requires that the conduit or open wire must be supported from the structural work of the building. Various methods of mounting conductors or conduits on beams and other structural members have been developed to facilitate this work.

This matter has been given special study by the Efficiency Electric Company, East Palestine, O., and as the result of its development work there has been produced a line known as the "Bestyet" mill fittings.

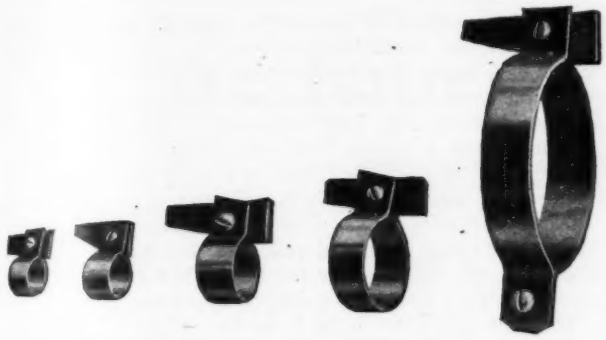


Fig. 1.—Several Sizes of the Wayman Conduit Hanger.

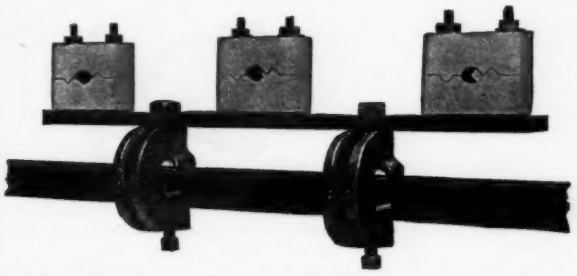


Fig. 4.—Wayman Adjustable Cable Rack With Insulating Cleats.

These comprise various devices, of which the Wayman conduit hanger, shown in several sizes in Fig. 1, is one of the most simple. This consists of a strong strap with an adjustable finger at the top. The method of using these hangers in connection with an I-beam is shown in Fig. 2, from which it is clear that the fingers grasp the flange on the beam. The same type of hanger is equally useful for angle bars, T-bars, Z-bars, channels and the like. The fingers are adjustable so as to take a metal flange ranging from 1/16 to 5/8-inch in thickness. These hangers are made suitable in standard sizes for conduits or pipes ranging from ½ to 4 inches and still larger sizes are made special.

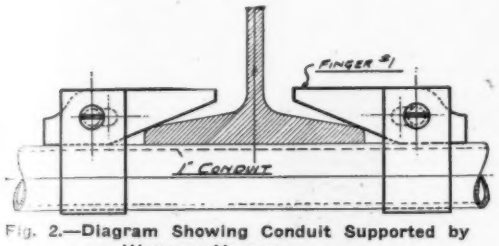


Fig. 2.—Diagram Showing Conduit Supported by Wayman Hanger.

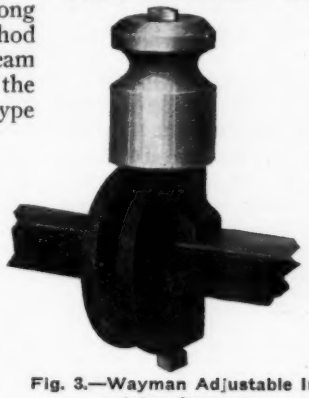


Fig. 3.—Wayman Adjustable Insulator Support.

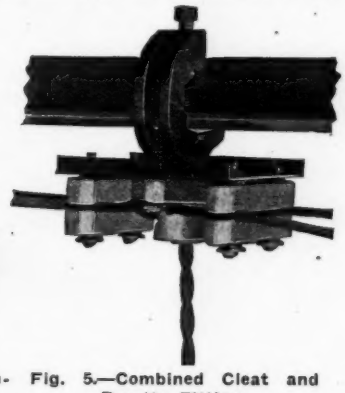


Fig. 5.—Combined Cleat and Rosette Fitting.

In Fig. 3 is shown what is known as the Wayman adjustable insulator support. It consists of a sturdy clamp, which can be quickly mounted on the flange of structural steel work of buildings, bridges, etc. A bolt at the opposite end of the clamping stud permits of mounting insulating knobs, glass insulators or special racks for mounting conduits, cleats and the like. The support shown in Fig. 3 is the 2-inch size. It is also made in 1½ and 3-inch sizes.

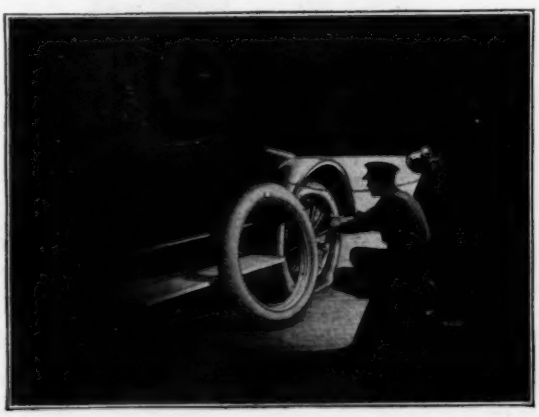
Adaptations of the Wayman insulator support are shown in Figs. 4 and 5; the former is known as the Wayman adjustable cable rack. The illustration shows that it consists of two of the supports similar to that illustrated in Fig. 3, on top of which is mounted a strap or bar, to which cleats or insulators can be adjustably secured. As shown, the rack has a length of 20 inches. This makes a very strong installation and which, like all the other fittings in this line, is very easily and quickly installed.

Another fitting shown in Fig. 5 is known as the Wayman rosette and cleat fitting, which consists of a 1½-inch Wayman adjustable insulator support, to which is secured a pressed-steel plate. Supported from the latter are two cleats and between them a rosette, thus making a very neat and substantial fitting for dropping a light from structural steel work.

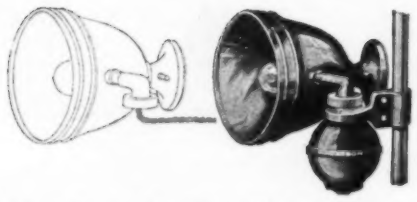
It will be observed in all these fittings that they are secured to the flanges of beams, columns and the like without the necessity for drilling holes or using wooden blocks. This means a great deal of saving of time and labor in their installation and the cost also is therefore materially reduced. Each fitting is reversible so that the wires or conduit can be run over or below the beam. Other fittings in this line are the combination cleat and conduit rack and a special pressed-steel cleat fitting.

Combination Dirigible Searchlight and Extension Inspection Light for Automobiles.

No automobile is complete nowadays without electrical equipment, not only for ignition and starting of the engine, but also for lighting the car. For the latter service it is desirable to have not only good headlights, but also an easily directed searchlight mounted on the front of the car, so that it can be turned to throw a very intense beam of light in any direction desired. Many such lights of this type have been on the market, but one recently introduced, known as the Anderson Autoreelite, possesses unique features. Its makers call it a three-in-one lamp, because it provides



Using the Autoreelite as Inspection and Trouble Lamp.



Pendent Type Autoreelite, Showing Extension.

a convenient searchlight, also a handy trouble or inspection light, and thirdly, a useful pleasure light for camping, picnics and similar purposes.

The accompanying illustrations show this device. It will be observed that while ordinarily the light is secured to the bracket, it may be readily detached therefrom and used as an extension lamp, either for inspecting parts of the car or for mounting on a tree or other object, so as to illuminate a camp or picnic ground or the like.

This extension feature is obtained by providing an automatic reel in the bulb-like portion of the device. This includes a spring, which causes the reel to wind up the cord automatically when the lamp is replaced on the bracket. The device is made in two types, one with a hollow bracket and the other with a pendent reel. Either a plain or special nonglare lens can be provided.

This device is made by the Anderson Electric Specialty Company, 562-564 West Van Buren Street, Chicago.

Self-Contained Battery-Charging Sets for Public Garages.

Many garages in the smaller towns are situated so that they have no central-station power supply available. In such cases and in others where central-station supply is not furnished, a self-contained battery-charging outfit is very desirable on account of the growing use of electrical equipment on all automobiles. To provide suitable charging equipment the Main Electric Manufacturing Company, Pittsburgh, Pa., has placed on the market several battery-charging sets, arranged to be driven from either a gas, gasoline

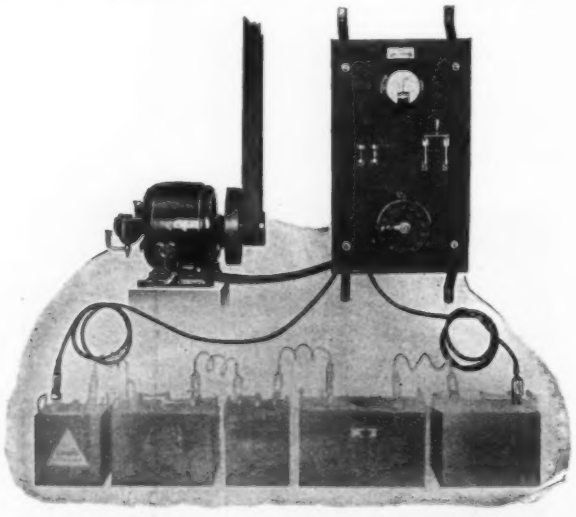


Fig. 1.—Battery-Charging Set for Use in Public Garage.

or oil engine, line shaft, motor or other source of power.

One of the simplest of these is shown in the accompanying illustration, Fig. 1. It consists of a direct-current generator of 800 watts capacity and designed especially for furnishing ample charging current for anywhere from one to five six-volt batteries. These are the three-cell batteries most commonly used for automobile lighting, ignition and starting service. The dynamo has a heavy flywheel alongside the driving pulley and is furnished with a sliding base to permit taking up slack in the belt. A control panel is furnished on which are mounted an ammeter of the double-reading type, a double-pole main switch, fuses and a large rheostat for regulating the charging rate.

In Fig. 2 is shown a larger set, which is designed for such garages where it is desired to provide not only current for charging batteries, but also for lighting the garage. The generator has a capacity of either 800 or 1500 watts and is designed for 40 volts. It has a flywheel pulley and a sliding base for belt adjustment. The control panel consists of an ammeter and voltmeter, two switches, fuses, automatic circuit-breaker and pilot lamp, and below it is an extra charging panel, including a large charging rheostat, a special ammeter, and extra long leads with lead-coated terminal clips for connecting to the batteries to be charged. The larger set of this type will light 75 20-watt 30-volt lamps when no batteries are being

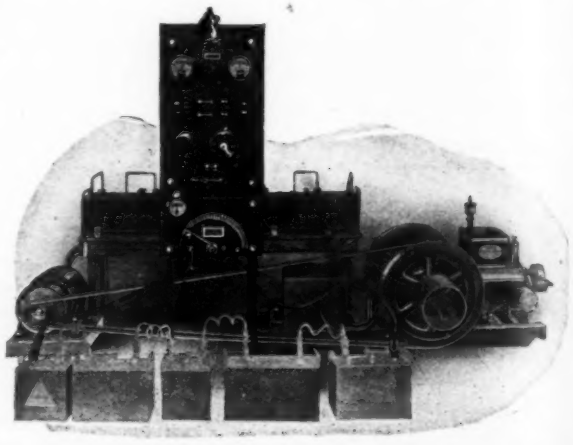


Fig. 2.—Combination Charging and Lighting Set for Large Garage.

charged. It will also light 25 of these lamps and furnish 25 amperes for battery charging. It will charge from one to five six-volt batteries in series or in any combination equivalent to 30 volts, such as two 12-volt batteries with one 6-volt battery.

These latter sets have a storage battery connected with them, which furnishes light when the generator is not running. In the illustration this battery is shown mounted on a shelf, directly back of the control panel. Some of these combination lighting and charging sets have been in operation for quite a few years and have given uninterrupted and entirely satisfactory service. They are a development of the Main Electric Manufacturing Company's smaller lighting sets which have been in very extensive use for rural and isolated installations for a great many years.

California's Oil Production and Consumption.

Oil production of the eleven fields in California for September amounted to an average of 274,635 barrels per day. The oil shipments during that month averaged 293,351 barrels per day. The net result was a depletion of stocks of oil amounting to 561,476 barrels in September. Existing plans in that state provide for an important increase of electric power production.

Activities in the Trade

General Electric Company, Schenectady, N. Y., has been awarded a contract by the Kansas City Light & Power Company, Kansas City, Mo., for two 20,000-kilowatt turbines.

The **Bordon Company,** Warren, Ohio, calls attention to arrangements for applying power-drive to its Beaver die stock, of interest to electrical men as well as plumbers and pipefitters.

General Electric Company employees, Schenectady, N. Y., subscribed for $1,440,750 of Liberty Loan bonds in the recent campaign. The company's employees bought over $1,000,000 Liberty bonds in the first issue.

Findley Electric Company, Minneapolis, in a newly-issued bulletin, gives several expressive shop pictures, and a view of the stock room, showing advantageously a part of its supply of motors. The stock includes alternating and direct-current motors. The cut of repair shop is an interesting feature.

Fort Wayne Works of General Electric Company, Fort Wayne, Ind., has begun the construction of another large reinforced-concrete building, thus making the larger portion of the works comprise a series of thoroughly modern, fireproof structures. The Bedford Stone & Construction Company has the general contract involving $125,000.

The **Trumbull Electric Manufacturing Company,** Plainville, Conn., is hastening the erection of a large addition to its factory, which, like the other sections, will be three stories and basement in height. A portion of the new structure will be used for the panel and switchboard department and another portion by the new safety service switch department.

Ford, Bacon & Company, engineers, 115 Broadway, New York City, announces they will give special attention to the appraisal of industrial properties, with the view to making returns for war tax purposes. The war profits tax section of the War Revenue Law requires the determination of invested capital, and cash valuations. Such appraisals are also necessary in arriving at costs of products, annual depreciation and other facts.

Employees Presented With Life Insurance.—Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., has presented each of its employees who have been in their service for one year or more a life insurance policy through the Metropolitan Life Insurance Company of New York. The amount of the policy is in accordance with the number of years of service, but will be increased from year to year, as each employee grows older in the service. The employee has the privilege of naming the beneficiary. The total amount of protection will amount to approximately $250,000, the expense of which will be paid by the Indiana Rubber & Insulated Wire Company.

Wirt Company, Philadelphia, Pa., has published a new bulletin on its Di-el-ite resistance units. These resistors are made in several convenient forms; one has copper end caps, another has ferrules to fit standard National Electrical Code fuse blocks, others are made as cylindrical and box-type iron-clad units and as regulating lamp-socket type resistors. The variety of forms, sizes, resistance values and wattage capacities of these units make them suitable for many purposes, such as for signaling systems, telephone and telegraph work, motor regulation, electrical testing, etc. A high-grade resistance wire is used in these units. The wire is imbedded in Di-el-ite insulation, an artificial stone-like composition containing principally quartz. It has high mechanical strength and will withstand temperatures of 800 degrees Fahrenheit and pressures about 400 volts per thousandth inch of thickness. Its use is not recommended in wet places. In a note about this bulletin published in our issue of October 20, typographical errors possibly prevented our readers from getting a good idea of what the bulletin deals with.

General Electric Company, Erie, Pa., has recently awarded contracts for the construction of a new seven-story pattern shop, about 75x300 feet, to cost $800,000; new one-story addition to its grey iron foundry, about 300x300 feet, to cost $300,000; and new two-story machine shop, about 240x800 feet, to cost $750,000, to the Henry Shenk Company, Twelfth and Sassafras Streets.

Edison Storage Battery Company has moved its New York City sales office from 206 West 76th Street to larger quarters at 209 West 76th Street, which is right across the street from the old location. Many additional facilities have been provided in the new quarters to enable the manager, John Kelly, to handle the increased business, and to give every customer the usual Edison service.

Electric Sales Corporation, 147 Henry Building, Seattle, Wash., has established agencies at Vancouver, B. C., and Los Angeles, Cal. R. V. Morrison has been appointed exclusive California representative for Apfel's patent electric heating device, manufactured by the Electric Sales Corporation, and C. H. E. Williams, well known electrical engineer of Vancouver, has been appointed exclusive representative in British Columbia for handling this same device.

Fore River Shipbuilding Company, Buffalo, N. Y., is planning for the erection of a large plant for the manufacture of turbines to be installed in war vessels of the destroyer type. The United States Government has recently awarded a contract to the company for the construction of a number of vessels of this character. The new plant, which is expected to be in operation within three months, will be located on Vulcan Street, between Tonawanda and Skillen Streets.

Westinghouse Electric & Manufacturing Company's catalogue 8-C, issued in September, and superseding an 8-C catalogue issued in April, 1916, is devoted to Westinghouse electric ware. The literature and illustrations relate especially to household appliances, covering a great variety and wide range of articles. The mantel or flush-type luminous radiators are presented in several styles and heat capacities. Motors mounted upon, and belt-connected to sewing machines are beautifully pictured. These are only some of the features.

Walter A. Zelnicker Supply Company, 325 Locust Street, St. Louis, Mo., has sent out its bulletin No. 226 in which it shows several views of its yards in East St. Louis that comprise 12 acres full of material ready for shipment. Included in these stocks are rails, pipe, plates, steel piling, beams and girders, locomotives, cars and trucks, tanks, wire rope, etc. The company has just purchased the plant, machinery, patents, stock and good will of the St. Louis Well Machine & Tool Company, which greatly increases its supply of materials and machinery.

S K F Ball Bearing Company, Hartford, Conn., has issued a finely-illustrated pamphlet of 48 pages on Wood Working Precision at High Speed. The subject matter pertains to the company's self-aligning ball bearings. These were first applied to wood-working machines, but they now enter into the construction of machinery of many other types. The illustrations referred to represent band saws of various types, planing and matching machines, jointers, shapers, dowel machines, sanders, floor surfacers, blowers and other machines; and a most interesting feature of the installations shown is that the high-speed electric motor drive is everywhere in evidence. The book is full of interest.

New Government Shipbuilding Plant.—With the commandeering by the Government of the Risdon Iron Works, embracing 30 acres of ground and eight shipbuilding slips directly south of the Potrero plant of the Union Iron Works, San Francisco, described in the October 13 issues of Electrical Review, the latter company will have greatly increased facilities for constructing the torpedo

boat destroyers for which it recently received a contract from the Navy Department. The Risdon Iron Works property was bought in May, 1911, by the United States Steel Corporation and has been used since by the United States Steel Products Company as a supply and shipping point for its export trade. Machine shops, fabricating shops and other buildings will be erected at once and the slips will rapidly be put into condition to handle two destroyer frames each, which means that 16 destroyers can be built at the Risdon plant at one time.

Hotpoint Electric Heating Company, Ontario, Cal., has produced and furnished to its distributors in all parts of the country a unique mission art window display, consisting of a three-panel screen three feet high and four feet wide. The frame is made of red-wood obtained from the famous redwood forests of California. About two carloads of this wood were used in the production of these displays, which are for use in the fall and winter selling campaign. The center panel of the display accommodates a 14 by 21-inch card, featuring catchy sales talks on the appliances illustrated in the attractive posters used in the side panels. Eight of these cards are furnished with each display. The name of the dealer is printed just below the selling talk. In the lower right hand corner of the card is shown a beautiful pen and ink sketch of one of the California missions. Sixteen attractive posters, lithographed in five colors, are furnished for use in the side panels of the display. Each one depicts the use of Hotpoint appliances in the home. Two of these posters are to be displayed at a time, thus affording eight changes for as many weeks. With each display is also furnished a set of richly colored mats, harmonizing in color with the posters. These mats are to be used as a covering on the floor of the window, with a display of Hotpoint appliances placed thereon. A booklet entitled "The Missions and Big Trees of California," accompanies each window display. This gives a brief history of the founding of the missions, and tells much of interest about the big trees of California. The Hotpoint Company publishes its distributors' windows who show this display by featuring it in Hotpoint national advertising in October 6th Saturday Evening Post one-page ad; two-color two-page center spread ad in December 1 Saturday Evening Post; two-color, full page ad in December Ladies' Home Journal and Good Housekeeping. These ads place Hotpoint Mission Art Display prominently before over 30,114,444 readers of these magazines.

Ivanhoe-Regent Works of General Electric Company, Cleveland, O., has issued catalog 235, on bowls and shades in Rozelle color decorations. A number of the illustrations in the bulletin are shown in beautiful colors to harmonize with various color schemes used in home decorations. The bowls and shades can be furnished for use as upright shades, or pendent shades and changes in color schemes will be made. Outline sketches are shown for various methods of installation. The illustrations comprise numerous Rozelle designs in colors and shades.

Pacific Machine Shop & Manufacturing Company, Seattle, Wash., is finding a very extensive demand for its electric winches. At the present time these are being installed on 14 wooden ships now under construction in Pacific Coast yards. The use of these electric winches has been found very economical, as they do away with the need of long lines of steam piping and the necessity for keeping up a special and usually inefficient donkey steam boiler. These winches have been used also to some extent on sailing vessels, which have Diesel oil engines for furnishing auxiliary power. This engine is arranged so that it can drive a generator which furnishes current for the motor on the winch.

Western Electric at New York Show.—Electrical household appliances as useful Christmas gifts and as the answer to the ever-increasing servant problem provided the underlying motif for the Western Electric Company's exhibit at the New York Electrical Exposition and Motor Show of 1917. Within the booth there was a semi-circular platform, divided into two parts by a wall. One side was fitted up as a living room and contained for demonstration such appliances as the portable sewing machine, vacuum cleaner, table, portable and floor lamps. The other side represented a kitchen, containing a washing machine, iron, range and dishwasher—all electrically operated. On the three sides of the booth, below the stage, the remainder of the complete line of Western Electric household products were exhibited and demonstrated. The exhibit was designed not only to interest housewives in the appliances themselves but rather to afford a liberal education in the ways in which electricity will assist in the scientific management of the home.

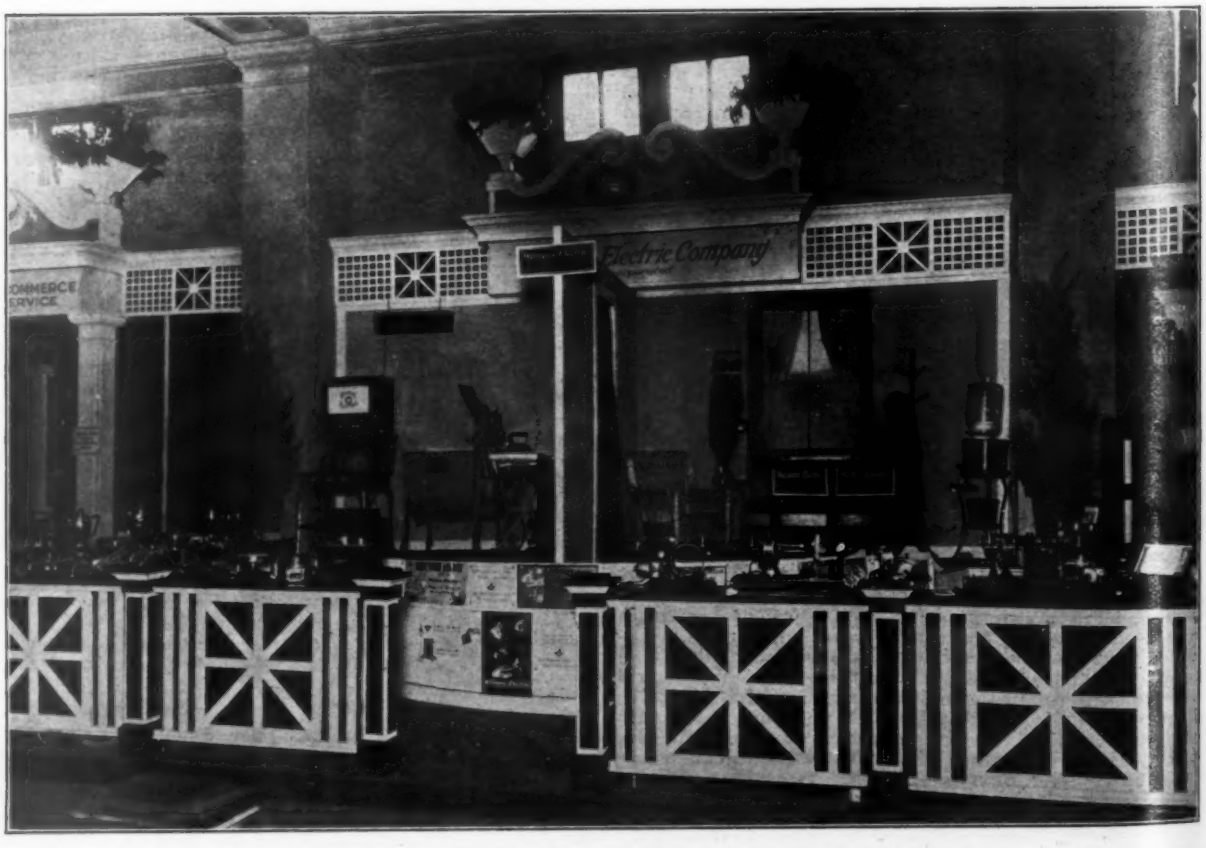


Exhibit of Western Electric Company at New York Electrical Exposition.

Latest Approved Fittings

The electrical fittings listed and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

Attachment Plugs, Fuseless. — Trumbull Electric Manufacturing Company, Plainville, Conn.

Separable attachment plugs having porcelain or composition bases or caps. "Trumbull," 660 watts, 250 volts, catalog Nos. 793, 798.

Listed September 8, 1917.

Heating Appliances, Cooking and Liquid. — General Electric Company, Schenectady, N. Y.

Electrically heated cooking appliances for voltages up to 250 volts. "G. E."

Broiler, 5,000 watts, type D-78.

Ranges, 600 to 3,600 watts, type D-77.

Listed August 10, 1917.

Motion-Picture Machines, Miniature.—The DeVry Corporation, 117 North Fifth avenue, Chicago, Ill.

Portable motion-picture machines of miniature type consisting of asbestos-lined wood case inclosing projector mechanism, film, incandescent lamp and driving apparatus. Made in three types (one new).

Motor-operated; 250-watt, gas-filled lamp; 3 amperes, 110 volts, type C-3.

Listed August 8, 1917.

Receptacles for Attachment Plugs, and Plugs.—A. & J. M. Anderson Manufacturing Company, 289 A street, Boston, Mass.

For use in series with switches and not for closing or opening circuits under load. 150 amperes or less, 600 volts or less, types ABC, N.

Listed August 10, 1917.

Receptacles, Medium-Base.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." metal shell.

Keyless catalog Nos. 7535, 68137.

Pull, catalog Nos. 4535, 68138.

Listed August 10, 1917.

Keyless catalog Nos. 1009, 60020.

Listed September 4, 1917.

Receptacles, Medium-Base.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." porcelain shell.

Catalog Nos. 1233, 1234, 4000, 4001, 50715; also above types with Shurlok attachments.

Listed September 3, 1917.

Resistance Appliances. — Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Controllers, bulletin Nos. 5225, 9401, 9403, 10175, 10430.

Self-starters, bulletin No. 9601.

Listed October 5, 1917.

Resistance Appliances. — General Electric Company, Schenectady, N. Y.

Motor-starting rheostats, types CR-2350, 2350-1, 2351, 2352-53, 2367.

Listed August 9, 1917.

Rosettes, Fuseless.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." 3 amperes, 250 volts, catalog No. 1214.

Listed August 20, 1917.

Sockets, Medium-Base. — John I. Paulding, New Bedford, Mass.

Composition weatherproof, keyless, 660 watts, 250 volts, catalog No. 43309.

Listed August 3, 1917.

Sockets, Mogul-Base.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." porcelain shell.

Keyless, catalog Nos. 1183-85.

Listed August 28, 1917.

Sockets, Mogul-Base.—Union Electric Company, Trenton, N. J.

"Union," porcelain shell, catalog Nos. 60-62 inclusive.

Listed July 26, 1917.

Switch Boxes.—The Adapti Manufacturing Company, 919-25 West Street, Cleveland, O.

Sheet steel, single and gang-type boxes for mounting switches and attachment-plug receptacles. (Adapti.)

Flexible tubing or rigid conduit patterns, catalog Nos. 11 N.W., 12 N.W., 13 N.W.

Listed August 14, 1917.

Switches, Door.—Benjamin Electric Manufacturing Company of Canada, Ltd., 11-17 Charlotte Street, Toronto, Ont.

"C-H." Single-pole, catalog Nos. 7240-41, 7245-46.

Listed July 21, 1917.

Switches, Enclosed.—Electric Railway Manufacturers' Supply Company, 36-40 Second Street, San Francisco, Cal.

Standard fused switch, mounted in a standard, labeled, sheet-metal cut-out box or cabinet and provided with a handle for manual operation, without opening the case.

Listed August 7, 1917.

Switches, Enclosed.—Palmer Electric & Manufacturing Company, 60 K Street, Boston, Mass.

Two or three-pole service switches and cutout bases for standard cartridge enclosed fuses, enclosed in metal cases and designed for manual operation without opening cases. When cases are open fuse terminals and all accessible parts are "dead," eliminating possibility of shock to operator in replacing or inspecting fuses.

"HP Safe Fused Switches," 30 amperes, 125 volts, 125-250 volts and 250 volts, catalog Nos. 306-09 inclusive; 31-100 amperes, 250 volts, direct current or alternating current, 0-60 amperes, 600 volts, alternating current, catalog Nos. 311, 313-15 inclusive, 321-24 inclusive.

Palmer meter-testing block, 30 amperes, 250 volts, catalog No. 800.

Listed August 13, 1917.

Switches, Enclosed.—General Electric Company, Schenectady, N. Y.

Quick-make and break induction-motor starting switch, equipped with time-element plugs designed to afford protection to motor against overloads maintained for longer than predetermined periods. Enclosed in metal case and designed for manual operation without opening case.

Type CR-1038, 3 horsepower, 110 volts; 5 horsepower, 250 volts; 5 horsepower, 550, 440, 220 volts; 3 horsepower, 110 volts.

Listed September 11, 1917.

Switches, Knife.—Trenton Electric & Conduit Company, Trenton, N. J.

"T. E. & C. Co." 30 amperes, 125 volts, catalog Nos. 1405, 1406, 1408, 1410.

Listed August 4, 1917.

Switches, Pendent.—Benjamin Electric Manufacturing Company of Canada, Ltd., 11-17 Charlotte Street, Toronto, Ont.

"C-H." Single-pole. Push, catalog Nos. 7000-03 inclusive, 7007, 7010, 7310 and "Feed-Thru," catalog Nos. 7040-43 inclusive.

Three-way. Push, catalog Nos. 7004-06 inclusive.

Two-circuit. Push, catalog Nos. 7020-21.

Three-heat. Push, catalog No. 7044.

Listed July 21, 1917.

Switches, Push Flush.—Benjamin Electric Manufacturing Company of Canada, Ltd., 11-17 Charlotte Street, Toronto, Ont.

"C-H." Single-pole, catalog No. 7201.

Double-pole, catalog No. 7202.

Three-way, catalog No. 7203.

Listed July 21, 1917.

Switches, Surface.—Benjamin Electric Manufacturing Company of Canada, Ltd., 11-17 Charlotte Street, Toronto, Ont.

"C-H." Single-pole, catalog Nos. 7102-05 inclusive, 7107-14 inclusive.

Listed July 21, 1917.

Switches, Surface.—Standard Electric Manufacturing Company, 216 North Clinton Street, Chicago, Ill.

Single-pole, catalog Nos. 3006-07, 3026-27, 3070, 4006-07, 4026-27.

Double-pole, catalog Nos. 3028-29, 4008-09, 4028-29, 4070.

Three-way, catalog Nos. 3004-05, 3032-33.

Listed July 19, 1917.

Men in Government Service

Items of Interest Concerning Power and Electrical Men Who Have Joined the Colors

DAKOTA CENTRAL TELEPHONE COMPANY, Aberdeen, S. D., reports 14 of its employes in military and naval service, which is nine per cent of its entire force.

GATES HARPEL AND PHILIP EICKENBERG, of the sales and engineering departments, respectively, of the George Cutter Company, South Bend, Ind., entered the Aero Service last April, and spent the summer in training at Fort Kelly, San Antonio, Texas. Recently they were transferred to the 21st Aero Squadron, at Scott Field, Bellville, Ill.

FRANK R. BACON, president Cutler-Hammer Manufacturing Company, Milwaukee, who was appointed captain in the industrial reserve early this year, has been detailed to active service as general supervisor of the execution of Government contracts for the manufacture of machine guns at New Haven, Conn. The position carries with it promotion to the rank of major. Because the new duties require his entire time, Major Bacon temporarily has relinquished active connection with the Cutler-Hammer company.

BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, reports thirty of its employes in the military and naval service of the United States. Twenty of these are enlisted men, ten having come in by the selective draft. As to service, 22 are in the army, six in the navy, one in the marine corps, and one enlisted in the Canadian army. Of those in service, 18 were shopmen, the others having been office men, warehouse and shipping men, and one salesman and one advertising man. Henry Pollard, who gave up his position as superintendent of the company's factory, is now in service in France as captain in the ordnance department. His appointment was due to his experience in shop practice, and to the fact that he had received military training at the University of Illinois. Frank P. Rice, a non-commissioned officer with Trench Mortar Battery No. 311, Rockford, Ill., served five years in the company's advertising department.

THE TENTH RESERVE TELEGRAPH BATTALION, formed last August at St. Louis, Mo., is made up of employes of Southwestern Bell Telephone Company, whose system covers most of the great Southwest. The officers of the Battalion are: F. A. Montrose, major; D. C. Rosser and P. J. Ramsey, captains; Humphrey Sullivan, first lieutenant and adjutant; E. H. Painter, first lieutenant and supply officer; H. C. Eppler, Jr., C. D. Cuny, W. H. Spencer, F. C. Walden, first lieutenants. The 209 men composing the battalion came from the several departments of the company's organization, extending to St. Louis, St. Joseph and Springfield, Mo.; Dallas, Denison, Ft. Worth, Houston, Galveston, San Antonio, and other points in Texas; Wichita, and other places in Kansas. These were all enlisted men, the majority of whom came from the company's plant department. They include four master electricians, 15 first class and 23 second class sergeants, 34 corporals. In September the battalion went in training at Leon Springs, Texas, 30 miles from San Antonio. Photographs of this body of young men in camp maneuvers show an even, vigorous, efficient unit.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW will *welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

MAJOR GEORGE BAILEY, U. S. R., who was manager of the supply division, Cincinnati office of the Westinghouse Electric & Mfg. Company, is with the 308th Engineers, Camp Sherman, Chillicothe, Ohio. Major Bailey entered the Reserve Officers' Training Camp at Ft. Benjamin Harrison last June and was later transferred to the Engineers' Training School at Ft. Leavenworth, Kans., where he received his commission early in August.

Major G. Bailey.

NATIONAL X-RAY REFLECTOR COMPANY, New York and Chicago, prints the names of 19 of its employes who are in military service, each ready to do his part.

ELGIN BRAINE, of the American Steel & Wire Company's electrical department, at Chicago, is quartermaster sergeant on General Pershing's staff in France. He is a son of L. F. Braine, well known through his connection with the Rail Joint Company.

ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., whose employes, to the number of 150, have enlisted in the several departments of army and navy service, publishes their names in its house organ under the caption "Our Boys at the Front." In this list the names appear under heads of different departments in which they were employed, also the branch of Government service with which they are now connected. It is shown that men have gone from all departments and from all branch establishments of the company throughout the country.

PAGE & HILL COMPANY, Minneapolis, Minn., has granted leave of absence to a number of its employes who have been assigned responsible posts, as follows: E. C. Stockdale, Chicago manager, has received a commission as major in the Quartermaster's Corps, at present assigned to Cantonment Division in Washington; J. E. Lynch, home office, is now acting as general superintendent of stores for American Ship Building Corporation, building shipping yards and ships at Philadelphia; John H. Gale, Minneapolis office, has been made first lieutenant of artillery and is now stationed at Camp Dodge, Des Moines, Iowa, and J. D. Burnes, chemist and inspection engineer for the company, is now in the Officers' Training Camp at Fort Snelling.

ILLINOIS ELECTRIC PORCELAIN COMPANY, Macomb, Ill., in line with nearly all manufacturing companies, for the present has lost the services of a number of its skilled employes, among whom we have the names of the following: Lennis Blivens, die department, enlisted in navy, now on cruiser Nashville; Cecil Van Fleet, die department, in navy, now on battleship New Jersey, as gunner; Clarence Croxton, die department, in Battery E, 14th Regiment, now at Ft. Sill, Okla.; James E. Zerkle, press department, in Battery B, 339th Regiment, in training at Camp Dodge, Des Moines, Iowa; Roy Case, kiln department, in Company C, 136th Infantry, training at Camp Cody, New Mexico; Earl F. Lovell, clay preparation department, now in training at Naval Hospital, Great Lakes, Ill.; Frederick G. Newell, tube department, now in Company F, 5th Regiment, Illinois Infantry; Carl Price, glazing department.

Personal and Biographical

EDWARD J. COOK, Rochester, N. Y., has announced his resignation as chief engineer of all the New York state electric railway lines.

HERBERT S. HALE, formerly in electrical work at Peoria, Ill., is now a member of 308th Signal Field Battalion, Camp Sherman, Ohio.

E. H. DAVIS of Houston has been appointed manager of the Texas Gas & Electric Company at Center, Texas, to succeed E. A. Davidson, resigned.

L. F. CHAMBERS has been appointed accountant for the Mankato (Minn.) division of the Northern States Power Company, succeeding O. T. McLean, resigned.

FRANK O. WALLENE, of Electric Machinery Company, Minneapolis, has been transferred from the factory to Cleveland, where he is opening an office as district manager for the company.

W. C. MADDOX, formerly with Harmon Engineering Company, Peoria, Ill., in steam-shovel and drainage work, is now with Westinghouse Electric & Manufacturing Company, at its Duluth office.

CHARLES W. MALCOLM, formerly sales manager for Geyser Electric Company, recently was appointed general manager of that company, the offices of which are at 321-323 North Sheldon Street, Chicago.

W. J. SWARTING has been appointed superintendent of the Peoples Gas & Electric Company at Mason City, Iowa. He was engineer on construction and operating work of the power house and gas works of the Peoples Power Company prior to his new affiliation.

SHERMAN CREAMER, Knowlton, N. J., formerly connected with the Lehigh & New England Railroad, has resigned to become associated with the Eastern Pennsylvania Power Company, Paulins Kill, near Warrington, Pa., in the capacity of night superintendent at the power plant.

J. F. STRICKLAND, president of the Dallas Electric Light & Power Company and president of the Texas Electric Railway, has been elected president of the Dallas Railway, which is to take over the electric railway properties in Dallas and operate them under the new service-at-cost franchise.

THOMAS LOGAN, Parkersburg, W. Va., was recently elected president of the Kanawha Traction & Electric Company, succeeding S. D. Camden. This company was recently taken over by the Monongahela Valley Traction Company for operation, and Mr. Camden is now chairman of the latter's executive committee.

A. L. MCCONNELL has become manager of the Cordova Power Company, Cordova, Alaska, where a 150-kilovolt-ampere, 2200-volt generator, to be driven by a Pelton water wheel, has been added to the equipment. Mr. McConnell formerly was connected with the Seward Peninsula Light & Power Company, Nome, Alaska.

R. B. MACDONALD has been made general manager of the Peoples Power Company at Rock Island, Ill. Prior to this connection he was superintendent and later general manager of the Fort Dodge Gas & Electric Company, Fort Dodge, Iowa.

W. A. THOMAS, consulting electrical engineer, Scranton, Pa., formerly in charge of the Westinghouse Electric & Manufacturing Company's mining division of industrial sales department, East Pittsburgh, is now vice president of Carbon Creek Coal Company, Scranton, whose mines are at Shamokin.

ARTHUR WILLIAMS, general commercial manager of the New York Edison Company, has received the appointment of Federal Food Administrator for New York City, as an important link in the nation-wide plan of food conservation

Arthur Williams.

and administration, that has been evolved and developed under direction of the Government Administrator, Herbert C. Hoover. Mr. Hoover, in a message to Mr. Williams, says: "The President has approved your appointment as Federal Food Administrator for New York City. I am greatly pleased that we are to have your invaluable service." On entering upon the important duties of the position, Mr. Williams stated: "I consider it a great privilege to be associated with Mr. Hoover in the nation-wide movement to conserve our resources. I have assured him that the people of New York will leave nothing undone that will tend to strengthen his right arm and will assist in every way the work of the National Food Administration.

Mr. Williams is known here and abroad. He has been decorated by France as an officer of l'Instruction Republique and by the king of Spain, who made him a Knight of St. Isabel. During the Spanish-American war he served as an officer in charge of mine laying in New York Harbor. He is 45 years of age, a native of Norfolk, Va., unmarried, and a man of independent means. He is one of the leading figures in the electrical industry, his central station career having begun in 1884, when the Edison company had its power plant at 257 Pearl Street. Mr. Williams is past president of the National Electric Light Association, the Association of Corporation Schools, the Association of Edison Illuminating Companies, the Electric Vehicle Association of America, the New York Electrical Society, and has served in an official capacity in many other electrical organizations.

Obituary.

JAMES J. KENNEVANE, connected with the Public Service Electric Company, Orange, N. J., for the past 20 years, died October 23, at his home, 203 Cleveland Street, in that city.

ROBERT DOUGLAS MILLER, assistant treasurer of the Public Service Corporation of New Jersey, died October 23, at his home at 515 Morris avenue, Elizabeth, aged 70 years. He is survived by his widow and a son.

HERBERT E. GOODMAN, vice president and general manager of Goodman Manufacturing Company, Chicago, died in this city October 3, 1917. He was born in Chicago and received his education in her schools. He founded and built up a large manufacturing business and was largely instrumental in the development and introduction of electrical equipment in coal cutting and mine haulage. In 1888 he became secretary of the Sperry Electric Mining Machine Company, by which the electric pick machine, designed by Elmer A. Sperry, was manufactured. W. D. Ewart and A. D. Dana, of the Link-Belt Machinery Company, came into the company, bringing it their financial support, the result being the manufacture of improved machines and their installation in a number of coal mines. Electric locomotives were built and placed in operation for coal haulage. It was then realized that coal cutting and mine haulage by electricity were practical and economical. When the Sperry Electric Mining Machine Company was absorbed in 1893 by the Thompson-Houston interests, Mr. Goodman organized the Independent Electric Company and purchased the patents and equipment of the Lechner Mining Machine Company, of Columbus, whereby the chain type of coal cutting machine was developed. The result was a traveling chain machine, the efficiency and superiority of which was proved in actual practice. A contract, secured in 1895, was for installing a complete mining plant at $54,000, and through the co-operation of Link-Belt Machinery Company the order was carried through. The business of the Independent Company was purchased later by the Link-Belt Company, pushing it as a branch of its other business. However, the electric mining machinery branch was taken over in 1900 by the Goodman Manufacturing Company, and that year the Goodman plant was established, which marked the beginning of a prosperous business in mining equipment, especially adapted to the use of electric power.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

SWANTON, VT.—Town Council is making rapid progress in the erection of its one-story hydroelectric power plant at Highgate. When completed the works will cost about $75,000. The H. P. Cummings Construction Company, Woodsville, N. H., has the contract for construction.

WEST LYNN, MASS.—General Electric Company has commenced the erection of a one-story factory, about 60x160 feet, at Lynn, and is rushing operations for early occupancy.

BINGHAMTON, N. Y.—Hires Condensed Milk Company, 913 Arch street, Philadelphia, Pa., has awarded a contract for the erection of a large power plant to be constructed in connection with its proposed new works to be devoted to the manufacture of tin cans. When completed, the entire plant is estimated to cost approximately $500,000. John L. Lewis, 36 Wall street, Binghamton, is the contractor.

BUFFALO, N. Y.—Kelly Island Lime & Transport Company, 110 Hamburg Turnpike, has had plans prepared for the construction of a new transformer station at its works.

BUFFALO, N. Y.—New York Central Railroad, Grand Central Terminal, New York, has awarded a contract for the erection of a new local signal tower, two-story, about 20x55 feet, on Curtis street, to cost about $5000. The Eastern Concrete Steel Company, Morgan Building, Buffalo, has the contract for construction.

CENTRAL ISLIP, N. Y.—State Hospital Commission is having plans prepared for the erection of a power house at the State Hospital. E. S. Elwood, Capitol, Albany, is secretary.

CLYMER, N. Y.—Clymer Power Corporation has made application to the Public Service Commission for permission to construct an electric-lighting plant and for approval of franchise.

EAST SALAMANCA, N. Y.—Buffalo, Rochester & Pittsburgh Railway, Buffalo, is making extensive improvements at its local power house to provide for increased capacity.

NEW YORK, N. Y.—John M. Huber, 65 West Houston street, has had plans prepared for the erection of a one-story power house addition to his plant at Sixth avenue and Sixty-second street, to cost about $4000. Brustus Gundlach, 212 Fifth avenue, is the architect.

NEW YORK, N. Y.—Wireless Improvement Company, 81 New street, has filed notice of an increase in its capitalization from $5000 to $150,000 for expansion.

NEW YORK, N. Y.—Enterprise Electric Novelty Company, 137 Greene street, manufacturer of portable flashlights and batteries, has announced that it will open headquarters on the Pacific Coast at 706 Sansome street, San Francisco, Cal.

OLEAN, N. Y.—Pennsylvania Railroad, Buffalo and Auburn Division, has awarded a contract for the erection of a one-story power house addition to its local works, which, in connection with other improvements, will cost about $20,000. The Tifft Construction Company, Iroquois Building, Buffalo, has the contract for construction.

ROCHESTER, N. Y.—Department of Public Works, City Hall, has had plans prepared for the erection of a one-story power house, about 40x80 feet at Irondequoit. C. M. Hirschfelder, 62 State street, Rochester, is the architect. E. H. Pierce is commissioner of the Department.

ROCHESTER, N. Y.—New York Telephone Company, 15 Dey street, New York, had plans prepared for the erection of a three-story local exchange plant, about 40x70 feet. The structure will be of brick and stone. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, are the architects.

ROCHESTER, N. Y.—North East Electric Company, 348 Whitney street, is planning for extensions and improvements in its power house. Plans have been prepared by Joseph Oberlies, Granite Building, Rochester.

WESTFIELD, N. Y.—Council had plans prepared for the remodeling and improving of the water works to cost about $80,000. C. C. Hill, Westfield, is designing engineer; J. A. Riley, clerk.

HADDONFIELD, N. J.—Town Commissioners are planning the early installation of a new municipal electric lighting plant near Evans Pond.

NEWARK, N. J.—Board of Education has awarded a contract for the erection of a large addition to the boiler plant at the Alexander Street Public School to cost about $15,500. The Frederick Fatzler Company, 810 Broad street, Newark, has the contract for construction.

NEWARK, N. J.—Neuman Hardware Company, 9-17 St. Francis street, has taken out a building permit for the erection of a one-story brick boiler plant, about 45x60 feet, to cost approximately $8500.

POMPTON, N. J.—Board of Education has completed the installation of new telephones in the Bloomingdale, Haskell, and Midvale schools.

POMPTON LAKES, N. J.—Common Council has leased the Edwin Corning property as a site with water power for the erection of a large addition to the municipal power plant to provide for increased capacity. Power in the new plant will be generated by hydraulic engines. The lease, which is for 21 years, involves an aggregate rental of $97,500, with provision that the Borough may purchase the property within the first 10 years at $100,000.

WRIGHTSTOWN, N. J.—Wrightstown Utilities Corporation, which recently acquired the old Wrightstown Water Company, is perfecting arrangements for the installation of a new electric lighting system for various streets.

ASHLEY, PA.—Central Railroad of New Jersey, 143 Liberty street, New York, has awarded a contract for the construction of a one-story power house addition, about 40x70 feet, at its local works, to cost $10,000. John W. Ferguson, Paterson, N. J., is the contractor.

BIRDSBORO, PA.—Reading Railway Company has completed improvements in its water system just south of Birdsboro, and is planning for the immediate installation of electric pumping machinery.

BOYERSTOWN, PA.—Boyerstown & Pottstown Railway Company has submitted a proposal to the Town Council for the purpose of connecting its road with the Oley Valley electric line to Reading by means of a loop on several streets. This would complete the last trolley link between Reading and Philadelphia.

BOYERSTOWN, PA.—The business of the Boyerstown Gas Company has been reorganized and the company has awarded a contract for the remodeling and extending of its plant. Immediately upon completion of this work, new machinery will be installed. F. Logan, Phoenixville, is the contractor. Thomas Gottshall has been elected manager.

CLEARFIELD, PA.—North Mahoning Township Light, Heat & Power Company has incorporated with a capital of $5000, to operate a local plant. W. O. Hoover is the principal incorporator.

MOUNT UNION, PA.—Raystown Light & Power Company has changed its system from water power to steam. The work is entirely completed, and it is anticipated that the new motive power will result in materially increasing the efficiency of the service.

PITTSBURGH, PA.—Department of Public Charities is making rapid progress in the erection of its power plant addition at Mayview. The structure is estimated to cost about $30,000. The Wilson Construction Company, Fulton Building, Pittsburgh, is the contractor.

PHILADELPHIA, PA.—Bellevue Worsted Mills, Wister street, have had plans prepared for the construction of a power house, about 30x40 feet, to be erected at Sixteenth and Hunting Park avenues.

SAYRE, PA.—Sayre Electric Company has recently secured a renewal of its street lighting contract with the officials of the Borough of Athens, covering a period of five years. The company has completed connections to the plant of the Hart Planing Mills for the purpose of supplying power for works operation.

WILMINGTON, DEL.—Illinois Leather Company, South Market street, has commenced the erection of a one-story power house addition to its plant, about 19x40 feet.

BALTIMORE, MD.—Hess Steel Corporation, Loney's Lane and Pennsylvania Railroad, has awarded a contract for the erection of a large addition to its electric furnace plant. The Crowell-Lundorff-Little Company, Cleveland, is the contractor.

BALTIMORE, MD.—Consolidated Gas, Electric Light & Power Company, Lexington street, has awarded a contract to the Consolidated Engineering Com-

Business is Good

In our opinion business in the State of Iowa cannot stop. Crops have been very good and people will not keep from spending money when they are prosperous.—J. B. Terry, J. B. Terry Company, Cedar Rapids.

pany, Calvert Building, Baltimore, for the construction of a one-story concrete and steel power plant addition to its plant at Falls Road and Pacific avenue.

CAPE CHARLES, VA.—An electric power house will be erected by H. Kellogg.

BLUEFIELD, W. VA.—National Armature & Electric Works of Bluefield has incorporated with a capital of $25,000, to operate here. P. J. Kelley, G. E. Stupalsky and others are incorporators.

TRIADELPHIA, W. VA.—Town Council is considering plans for the installation of an electric lighting system.

FREMONT, N. C.—Town Commission is planning to issue bonds for $20,000 to provide for the installation of an electric lighting plant.

PIKEVILLE, N. C.—Town commissioners will issue bonds with which to install an electric lighting plant and improve the streets.

CORNELIA, GA. — Wofford Shoals Light & Power Company has been awarded a contract by the town officials for furnishing service for its street lighting system, and is planning for the construction of a transmission line from Clarkesville to Habersham Mills.

NORTH CENTRAL STATES.

MOUNT PROSPECT, ILL.—Northwestern Light & Power Company has incorporated with a capital of $5000. The incorporators are William Busse, Edward Busse, Henry J. Ehard, Ralph L. Peck and Henry Beigel.

TRAVERSE CITY, MICH.—The plant of the Boardman River Electric Light & Power Company recently was damaged by an explosion of a dynamo hotbox. A short time ago the dam and spillway of the works was destroyed. The loss on the first casualty was $7500 and the latest $50,000. All damaged parts will be rebuilt.

ALMA, WIS.—Alma Electric Light Company's plant has been bought by the Wisconsin-Minnesota Light & Power Company.

CAMBRIA, WIS.—Cambria is installing a white way, consisting of 24 posts, with one globe each. The power will be furnished by the Wisconsin Light, Heat & Power Company. The cost of installing the system will be $1800.

GRESHAM, WIS.—At a special election it was voted to bond the village for $14,000 for buying the water power and electric lighting plant of Richards Brothers.

ATWATER, MINN.—Franchise has been granted to the Light & Power Company of St. Cloud for an electric lighting system.

RICE, MINN.—Contract for the distribution of lights in Rice has been let to Sterling Electric Company, 33 South Fifth avenue, Minneapolis. Earle D. Jackson, Capital Bank Building, St. Paul, consulting engineer.

SIOUX CITY, IA.—Sioux City Gas & Electric Company has taken out building permit to construct a $25,000 addition to its plant at First and Court streets. The addition will be 27x37 feet and be fireproof. Room will be provided for a new electric generator, which the company has found necessary to install, because of an increasing demand for electrical service.

ARKANSAS CITY, KANS.—Members of the firm of the Phoenix Construction Company of Wichita have arrived here and will soon begin work on improvements to the electric light plant. When they have finished, the capacity of the plant will be doubled.

JEFFERSON CITY, MO.—Empire Electric Supply Company of Joplin, Oct. 13, filed an application to sell all of its holdings to the Empire District Electric Company. The former company has large holdings in Joplin, Carthage, Webb City, and a number of Missouri and Kansas towns in the zinc mining belt.

BARNES, KANS.—Election to vote $10,000 in bonds for installation of electric lights in the city carried.

CUBA, KANS.—A special electric lighting bond election has been called for Nov. 9, for deciding on having Concordia Electric Light & Power Company build and maintain a transmission line into this city for light, heat and power. The amount of bonds to be voted on is $10,000.

HURON, KANS.—B. R. Hinchman, of Lancaster, is making preparation to light Huron with electric lights. A transmission line now extends from Atchison to Everest and Mr. Hinchman will tap this line and build an extension to Huron.

McPHERSON, KANS. — Neighboring towns want electric current and a bond election is to be held and the proposition will be to issue 10-year bonds. A line to Galva will be built by McPherson. This will include street lighting system. For this a franchise of 25 years will be given.

READING, KANS.—The electric light plant has changed hands. C. H. Shoup and Henry Jacoby disposed of it to Earl Petty of El Dorado.

OMAHA, NEB.—A new 40-stall roundhouse, machine shop, power plant and coaling station, freight trackage and other improvements at the Union Pacific terminal in Council Bluffs, Ia., to the value of more than $2,000,000 are on the Union Pacific construction program for the coming year. Details of the terminal work will be made public this week.

ORD, NEB.—Bids will be received for engines, generators, switchboard, distribution system and tower for electric light plant. Electrical Development Company, Sioux City, engineer.

CRARY, N. D.—John W. Ebert has been granted a 20-year franchise to operate an electric lighting plant here.

GRAND FORKS, N. D.—The ornamental street lighting system of Grand Forks is now being served by the local division of the Northern States Power Company, which also expects to take on city's pumping load within a few days. This business was recently secured by the company under a 10-year contract, which will save the city thousands of dollars every year under the cost of operating its own plant.

TIOGA, N. D.—A bond issue of $6000 for the electric lighting machinery and equipment is being considered.

SOUTH CENTRAL STATES.

ALAMO, TENN.—City is said to be considering the erection of a new electric lighting plant, and will issue bonds for $10,000 for this purpose.

DECATUR, ALA.—City voted an issue of $50,000 for the building of a municipal plant.

NATCHEZ, MISS.—Natchez Manufacturing Company, recently incorporated with a capital stock of $150,000 to operate the Natchez cotton mills, is planning for the complete electrification of its plant.

EARLE, ARK.—Earle Light, Water & Ice Co. has increased its capital stock from $15,000 to $60,000.

BRISTOW, OKLA.—Requests for street lighting have been so insistent that Mayor Schrade proposed buying the electric equipment of the Bristow Ice & Light Company. If the plant cannot be acquired it is planned to construct a municipal plant.

ENID, OKLA.—Oklahoma Gas & Electric Company will serve the Alton Mercantile Company with an additional power load of 50 horsepower in motors as soon as its new building is completed, bringing the total power requirements of the company up to 87 horsepower.

LAVERNE, OKLA.—Election will be held Nov. 9 to vote bonds in a sum not to exceed $13,000 for purpose of purchasing, extending and operating a system of works now owned and operated by the Laverne Light, Power & Ice Company.

MEDICINE PARK, OKLA.—J. Elmer Thomas, of Lawton, contemplates improvements, the specifications of which include an electric lighting plant.

AMARILLO, TEX.—At a meeting of the county commissioners, it was decided to put in the White Way system of lights.

BOWIE, TEX.—At a recent election here, $15,000 bonds were voted, the proceeds to be used in the construction of an electric lighting and power plant.

DALLAS, TEX.—Dallas Railway Company will build five railway lines and extensions to serve Second avenue, Oakland Cemetery, City Hospital, Oak Lawn, Dallas University and Oak Cliff.

DECATUR, TEX.—Municipal electric light plant is to be equipped with a new engine and other machinery.

HOUSTON, TEX.—An agreement that means a saving of $8000 to $10,000 a year to the city on electric current was reached Oct. 13 by Mayor J. C. Hutcheson and representatives of the Houston Lighting & Power Company, provided the city council will ratify the agreement the company agrees to replace all arc lights with the type C Mazda as the old lights wear out.

LUBBOCK, TEX.—City will soon be ready to connect the street lights with the city plant and there is a movement on foot to extend the white way within a short time.

NAVASOTA, TEX. — Intermountain Light & Power Company started a construction force recently to entirely rebuild the distributing plant of the lighting system of this city.

STAMFORD, TEX.—Stamford Gas & Electric Company, which recently completed the construction of the power transmission line to Hamlin, will extend the line to Anson. Three new substations will be built.

WESTERN STATES.

BUTTE, MONT.—A reorganization of the city lighting system is suggested, which would involve changes in lamps to cost about $6500, giving 47,000 candlepower more light.

MALTA, MONT.—George W. Kemper, of Minot, N. D., has received the contract for the installation of an electric lighting system at an estimated cost of $39,000.

PLEVNA, MONT.—Stater Brothers of Baker, Mont., have asked for a franchise to establish an electric lighting and power plant here.

ALBUQUERQUE, N. M.—Board of County Commissioners has granted to the State Line Utilities Company the right to string a high tension electric line from the power plant which is to be located at Texico along the road connecting that place to Clovis, and south to Portales.

BENT, N. M.—Tularosa Copper Basin Mining Company will enlarge its oil reduction mill and install machinery at its mine here. This company also owns water power on the Tularosa River, where it will build a hydroelectric plant.

HOLBROOK, ARIZ.—Snowflake and Taylor are to have electric light and power. Local capital has been raised to the extent of $50,000 for the purchase of machinery. Water power will be used and the cost of operation is expected to be very low.

OATMAN, ARIZ.—The Gold Ore Mine at Gold Road is being equipped with electrically operated machinery, including a hoist and a compressor.

HAILEY, IDA.—An election will probably be called about Nov. 15 to vote on the question of issuing $90,000 in bonds for a power and water system.

SEWARD, ALASKA.—Chitina Kuskulana Copper Company has installed a 62½-kilovolt-ampere, 60-cycle, 2200-volt alternator, and a 100-horsepower steam plant on the banks of Kuskulana River; and has constructed a 3-mile transmission line from there to its mine, where an air compressor will be operated by a

DATES AHEAD.

Electric Power Club. Fall meeting, Hot Springs, Va., November 12-13-14.

Electrical Supply Jobbers' Association. Next meeting, Hotel Sinton, Cincinnati, Ohio, November 13-15. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago.

Ohio Society of Mechanical Electrical and Steam Engineers. Annual meeting, Columbus, O., November 15. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

American Institute of Consulting Engineers, Inc. Annual meeting, January 14. Secretary, F. A. Molitor, 35 Nassau Street, New York City.

Electrical Contractors' Association of State of Missouri. Annual convention, January 19. Secretary, A. J. Burns, 318 West Tenth Street, Kansas City, Mo.

Minnesota Electrical Association. Annual convention, Minneapolis, Minn., January 20. Secretary, G. M. Jones, 112 South Seventh Street, Minneapolis.

Illinois Electrical Contractors' Association. Annual convention, January, 1918. Secretary, L. B. Van Nuys, Central Electric Company, Peoria, Ill.

50-horsepower motor. Angus MacDonald is manager.

AUBURN, WASH.—Valley Gas Company has asked for a franchise for the sale of electric current in the city.

EVERETT, WASH.—A special election will be called this winter to vote on the question of the city engaging in the production and sale of electric power.

EVERETT, WASH.—W. J. Rucker reports that a combination mill and power project may be constructed by the Sound Paper Company. The cost of the hydro-electric plant is estimated at $300,000 and power may be derived from the Sultan basin.

PORTLAND, ORE.—Several bonding companies have offered to take up the proposed $90,000 bond issue which the mayor and the council proposed to issue for the construction of a municipal power and water system.

ANTIOCH, CAL.—J. A. Hunt, of Pleasanton, Cal., will open an electric store here in the near future.

BAKERSFIELD, CAL.—Board of Supervisors has advertised for bids for the construction and maintenance of an electric lighting pole line. Each bid must be accompanied by a certified check of 10 per cent of the amount of the bid.

BRAWLEY, CAL.—J. A. Elmore, who has 1000 acres under cultivation, is agitating a plan for the installation of a system of 10 auxiliary pumps that will lift 300 second feet each a distance of 170 feet above the river level to insure an adequate supply of water for farming. Such a plant would cost about $500,000, or a dollar an acre for the land to be served.

PETALUMA, CAL.—Plans are in preparation for the installation of conduits for electric wires so that electroliers may be installed by the property owners on Main street.

PORTOLA, CAL.—Grizzly Electric Company's plant here has been destroyed by fire. The loss is $7000, partly covered by insurance.

SAN DIEGO, CAL.—San Diego Gas & Electric Company has about completed the electric lighting system for Camp Kearney, one of the Government cantonments for the new national army.

SAN FRANCISCO, CAL.—Board of Public Works has advertised for bids for the installation of electric conductors and appurtenances on the Market street line, from the East Portal of the Twin Peaks Tunnel to Church street and from Van Ness avenue to Geary street. The estimated cost of the work is $6000.

SAN FRANCISCO, CAL.—California Railroad Commission has authorized Southern Sierras Power Company to distribute electric current in the town of Blythe.

SAN FRANCISCO, CAL.—The following bids have been received for the electric lighting fixtures for the Southeast Wing of the San Francisco Hospital; Roberts Manufacturing Company, proposition one, $7750, proposition two, $9180; Thomas Day Company, proposition one, $8297, proposition two, $9717; and Lee J. Meyberg, proposition one, $8297, proposition two, $9598.

SAN FRANCISCO, CAL.—San Francisco Municipal Railway has received franchise for the erection of an electric railway from Twin Peaks Tunnel to Twentieth and Taraval streets; estimated cost $90,000. T. A. Cast, superintendent, 26 Geary street.

ST. HELENA, CAL.—City Board of Trustees has advertised for bids for the lighting of the town.

STOCKTON, CAL.—Samson Sieve-Grip Tractor Company, which is served with its electrical power requirements by Western States Gas & Electric Company, has added 150 horsepower in motors to its electric load to care for increasing demands, large numbers of farm tractors being now shipped to the French Government.

PROPOSALS

LIGHT AND WATER SYSTEM.—Bids will be opened Nov. 8 for light and water system at Pender, Neb. The specifications include two 11x12 side crank, 300-revolutions-per-minute unaflow steam engines; one 50-kilovolt-amperes, 3-phase, 60-cycle, 2400-volt, 300-revolutions-per-minute-alternating-current engine type generator; rewinding the 50-kilovolt-ampere, 3-phase, 60-cycle, 1100-volt, 300-revolutions-per-minute Western Electric alternating-current generator for 2400 volts, and for reboring motor to fit shaft; one 3-panel switchboard, one 5-kilovolt-ampere 5.5-ampere series street lighting transformer; one 125-horsepower open-type feedwater heater; 3580 pounds No. 6 T. B. W. P. copper wire; 48,080 T. B. W. P. copper wire; 9 5-inch x 20-feet Northern white cedar poles; 91 6-inch, 30-foot Northern white cedar poles; one quantity of pole-line material; one 3-kilovolt-ampere, 2400/100-220-volt high efficiency type transformers; two 5-kilovolt-ampere, 2400/100-220-volt high efficiency type transformers; one 2-stroke, deep-well pump with one 10-horsepower 200-volt slip-ring motor; two 5-kilovolt-ampere transformer; one 10-inch gravel treated well, approximately 55 feet deep. Henningson Engineering Company, Omaha.

LIGHTING FIXTURES.—Supervising Architect, James A. Wetmore, Treasury Department, Washington, D. C., will receive sealed bids until Nov. 8 for furnishing and installing lighting fixtures in the United States post offices at Berlin, N. H.; Burlington, Wis.; Cameron, Tex.; Chariton, Ia.; Ft. Morgan, Colo.; Frederick, Md.; Hammond, La.; Hiawatha, Kans.; Madison, S. D.; Maquoketa, Ia.; Marion, Ky.; Martins Ferry, O.; Martin, Tenn.; Media, Pa.; Mena, Ark.; Pulaski, Va.; Reading, Mass.; Richfield, Utah; Savanna, Ill.; Statesboro, Ga.; Wahoo, Neb.; Wenatchee, Wash., and the post office and court house extension at East St. Louis, Ill., and the post office and court house extension at Huntington, W. Va. Drawings and specifications may be obtained from the Supervising Architect's office.

ELECTRICAL EQUIPMENT.—William G. Keith, commissioner of gas and electricity, 614 City Hall, Chicago, Ill., will receive bids until Nov. 7 for furnishing and installing electrical equipment in the South Chicago substation, and for furnishing and delivering additional electrical apparatus in connection with installation of an electric lighting system for the City of Chicago, Department of Gas & Electricity. Materials are to be strictly in accordance with specifications and drawings on file in the commissioner's office.

MOTORS AND CENTRIFUGAL PUMPS.—Board of Sewerage Commission, City Hall, Brockton, Mass., will receive bids until 11 a. m., Nov. 15, for furnishing three electric motors and three centrifugal pumps with necessary piping, wiring, etc.

ELECTRICALLY-OPERATED CRANES.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids Nov. 19 for three electrically-operated fitting-out cranes of 350 gross tons capacity, at the navy yards at Norfolk, Va., New York and Philadelphia.

ELECTRIC FIXTURES.—Bids will be received at Fremont, Neb., until Nov. 6 for furnishing electric fixtures at the court house. Plans are with Architects A. H. Dyer Company, Fremont; address A. W. Murphy, Chairman of Board of Supervisors.

LIGHT BONDS.—Bids will be received until Nov. 6 by W. S. Davis, town clerk, for the purchase of $6000 five per cent light bonds.

ELECTRICAL EQUIPMENT.—Bids will be received after Nov. 15 for electrical improvements, which include boilers, engines, generator, switchboard and pumps. Address Fuller-Coult Engineering Company, Chemical Building, engineer.

PUMP AND SWITCHBOARD.—Sealed bids will be received at Room 216 City Hall, Philadelphia, Pa., for contract 16-H main switchboard and contract 16-J two-motor-driven centrifugal pump. Address George E. Datesman, director.

TRUCKS AND SHEARS.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids on two electric transportation trucks of 4000-pounds capacity, for delivery at Newport, R. I., schedule 1534 and one motor-driven, direct-connected squaring shears, for delivery at Mare Island, Cal., schedule 1540.

Electrical Patents Issued October 16, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,242,907. Insulator. A. O. Austin, assignor to Ohio Brass Co., Mansfield, Ohio. Structure of metal suspension cap for an insulator.

1,242,910. Motor-Control System. H. L. Beach, assignor to Westinghouse Electric & Mfg. Co. Relates to manipulation of armature resistance.

1,242,936. System of Distributing and Control. R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. For controlling motors driven through phase converters.

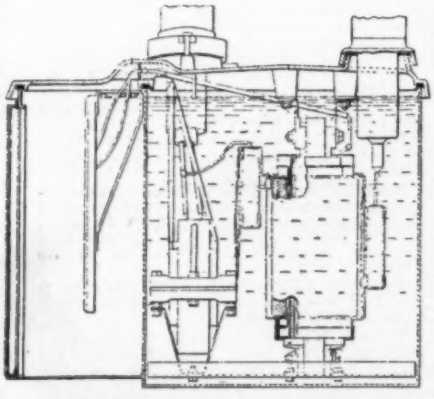
1,242,937. System of Control. R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. Modification of above.

1,242,959. Electric Starting Mechanism. L. R. McCutchen, Memphis, Tenn. Manner of connecting motor with engine.

1,242,962. Transformer for Metering Systems. J. E. Mateer & W. R. Woodward, assignors to Westinghouse Electric & Mfg. Co. Structure of polyphase device. (See cut.)

1,242,971. Stabilizing and Power-Factor Correcting Means for Electrical Circuits. J. F. Peters, assignor to Westinghouse Electric & Mfg. Co. In alternating system for operating a number of arc furnaces.

1,243,004. Method of Electric Welding and Articles Produced Thereby. A. C. Taylor, Warren, Ohio. Spot welding.



No. 1,242,962—Transformer for Metering System.

1,243,009. Electrode and Process of Making the Same. J. E. Thomsen, assignor to J. Dixon Crucible Co., Jersey City, N. J. Hard, noninflammable substance produced from a mixture of carbon, tar and a compound containing the formaldehyde radical.

1,243,043. Method and Apparatus for Producing Oscillating Currents of High Frequency. A. H. Cohen, Oakland, Cal. Spark gap structure.

1,243,047. Electrical Signaling Device. W. W. Dean, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Electric sounding horn.

1,243,048. Thermic Telephone. P. de Lange and R. A. V. van Lynden, assignors to Naamlooze Vennootschap De Nederlandsche Thermo-Telephoon Maatschappij, Utrecht, Netherlands. Structure and mounting of heat conductor.

1,243,057. Wire Hanger. A. L. Fox, E. St. Louis, Ill., assignor to T. C. White Electrical Supply Co. For suspending trolley from hanger.

1,243,066. Network for Neutralizing the Characteristic Reactance of a Loaded Line. R. S. Hoyt, Brooklyn, N. Y., assignor to American Telephone & Telegraph Co. Arrangement of impendance elements.

1,243,067. Stop-Motion for Motion-Pic-

ture Machines. E. B. Hulsey & J. A. D. Herrington, Tupelo, Miss. An alarm, the motor and dowser are controlled by breaking or tearing of film.

1,243,094. **Spark-Plug.** W. O. Olson, Chicago, Ill. Structural details.

1,243,098. **Electroplating Apparatus.** L. Potthoff, Flushing, N. Y. Structure and mounting and manner of forming connection with cathode rails.

1,243,111. **Galvanic Cell.** J. F. Sanders, assignor to O. P. Coshow, Roseburg, Oreg. Cathode is made of palladium and rhodium.

1,243,142. **Machine for the Manufacture of Tapes Containing Parallel Electric Wires.** A. de Capitani, Milan, Italy. Details of machine for making such tapes with eyelets set at intervals.

1,243,156. **Flash-Light Device.** N. E. Goldhadden, Chicago, Ill. For cameras: details of electric ignition.

1,243,164. **Sign and Process of Making the Same.** R. Hardesty, Denver, Colo. Letters are spot welded to plate.

1,243,166. **Electric Switch.** G. W. Hart, West Hartford, Conn. Two-push-button controlled, solenoid actuated.

1,243,169. **Automatic Player for Musical Instrument.** H. F. Herman, assignor to Imperial Piano Player Co., New York, N. Y. Perforate sheet controlled electro-magnetically controlled piano player.

1,243,202. **Storage Battery.** W. H. Muzzy, Dayton, Ohio. The upper end of jar is completely sealed by a water tank. [See cut.]

1,243,204. **Current-Collecting Device.** L. C. Nichols, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Structure of brush holder.

1,243,205. **Spark-Plug.** J. T. Norman, Nanticoke, Pa. Details of construction.

1,243,219. **Electrical Valve.** W. D. Ralphus, Pasadena, Cal. Solenoid operated fluid valve.

1,243,221. **Circuit-Controller.** W. C. Reed, assignor to Telelectric Co., Pittsfield, Mass. Arrangement of retaining and exciting coils in electromagnetically operated switch.

1,243,223. **Power-Transmission Gear.** J. Robson, assignor to Variable Speed Gear Ltd., Westminster, England. When gear breaks, driving motor is automatically connected for hand operation.

1,243,236. **Protector for Lamps.** J. G. Wissinger, Rutherford, N. J. Structure of glare protector of flexible sheet material, for head lights.

1,243,238. **Electric Fan.** A. Adamo, Detroit, Mich. Details of standing device wherein the motor is surrounded by fan blades.

1,243,246. **Outlet Box.** W. A. Bonnell, Brooklyn, N. Y. Details of structure comprising knock-outs.

1,243,261. **Circuit-Controlling Device.** H. P. Clausen, assignor to Western Electric Co. Has thermally expansible members for opening and closing a circuit.

1,243,262. **Motion Picture Camera.** C. J. Coberly, Glendale, Cal. Method of neutralizing charges on film.

1,243,266. **Direction-Signal and Alarm.** H. Curtiss, Ypsilanti, and G. F. Curtiss, Plymouth, Mich. Details of electromagnetically operated mechanism.

1,243,274. **Method and Apparatus for Electrically Making Copper Tubes.** E. Emmerson, Auburn, R. I. Electro-deposition process.

1,243,279. **Vehicle-Signal.** H. L. Freehafer, Denver, Colo. Motor operated and electrically illuminated direction indicator.

1,243,280. **Electric Action for Organs.** E. F. Frost, Washington, D. C. Details of control system for instrument having an electro magnetic pipe sounding device for each pipe.

1,243,283. **Electrical-Service-Cut-out Seal.** W. W. Givot, Omaha, Nebr. Fuse block has sockets and adjacent terminals covered by a seal-cap.

1,243,286. **Slip-Ring for Dynamo-Electric Machines.** W. Gscheidlen, assignor to Siemens-Schuckertwerke, G. M. B. H., Berlin, Germany. Is a helical, edge-wise wound strip.

1,243,307. **System of Distribution and Control.** B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Railway system wherein polyphase motors are operated from single phase source.

1,243,308. **Signal System.** M. E. Launbranch, assignor to Peerless Electric Sign Co., Chicago, Ill. Sign flashing arrangements.

1,243,314. **Telephone Metering System.** A. E. Lundell, assignor to Western Electric Co. Relates to control of message registers in an automatic system.

1,243,316. **Lamp Attachment for Sewing Machines.** W. W. and C. G. McClay, Chicago, Ill. Arrangement of bracket arm for supporting lamp near needle.

1,243,320. **Automobile-Signal.** J. H. MacLean, Ann Arbor, Mich. Arrangement and control of light circuit for direction indicator.

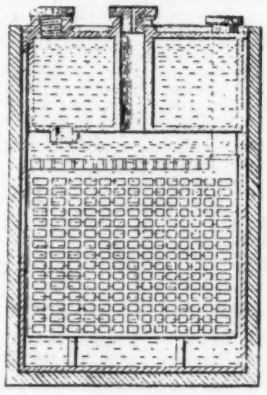
1,243,345. **Liquid Dynamic Balancing Machine.** C. B. Rodgers, Bordentown, N. J. Transfer of liquid for balancing purposes is electromagnetically controlled.

1,243,358. **Supporting Means for Electric Motors.** C. F. Stoddard, Boston, Mass. Construction of supporting standard comprising felt bushings encircling the bearings.

1,243,368. **Separator for Storage Batteries and Process of Producing the Same.** T. A. Willard, Cleveland, Ohio. Layers of porous material are united by binder and then sliced transversely to layers.

1,243,369. **Tubular Diaphragm for Storage-Battery Electrodes and Process of Producing the Same.** T. A. Willard. Tube has porous material embedded in and extending through the walls.

1,243,370. **Storage-Battery Separator and Process of Producing the Same.** T. A. Willard. Fibrous material is cemented together and the mass sliced so that the fibres extend through the plates.



No. 1,243,202—Storage Battery.

1,243,371. **Porous Tube for Storage Batteries.** T. A. Willard. Formed of two series of semi-circular tube sections of rubber and porous material extending there through, secured together.

1,243,372. **Method of Making Storage-Battery Separators.** T. A. Willard. Plate comprising porous material is made more porous by expanding the blank and then applying the ribs.

1,243,412. **Electric Sad Iron.** D. C. Hughes, assignor to D. C. Hughes & Co., Chicago, Ill. Manner of mounting the heating elements.

1,243,418 and 1,243,419. **Block-Signal System.** M. R. Julian, Birmingham, Ala. First patent: speed control, cab-signal system. Second patent: Details of speed controlled, brake applying system.

1,243,422. **Engine-Starting System.** C. F. Kettering & W. A. Chryst, assignors to Dayton Engineering Laboratories Co. System wherein starting motor is also used as generator for battery charging.

1,243,430. **System of Distribution and Control.** B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. For operating polyphase railway motors from single phase source.

1,243,433. **Door-Lock.** W. A. Lurie, Chicago, Ill. May be electromagnetically released to permit opening of the door.

1,243,453. **Lighting-Fixture for Display-Cases.** E. M. Smith, assignor to Multi-Lux Illuminating Co., Cleveland, Ohio. Structural details.

1,243,457. **Railway Selective System.** K. E. Stuart, Philadelphia, Pa. Arrangement of switch contact element for electromagnetically operating track switches from cars.

1,243,491. **Electric Light Fixture.** R. M. Beard, New York, N. Y. Indirect; for mounting on ceiling outlet box.

1,243,482. **Electric Push Button.** D. E. Blair, Montreal, Quebec, Canada, assignor to Edwards & Co. Structural details.

1,243,490. **Electric Heater.** H. W. Denhard, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Relates to means for supporting sad iron out of contact with its supportig surface and also for supporting the iron in inverted position.

1,243,510. **Automobile-Signal.** C. F. Gromann, New York, N. Y. Structure of electrically illuminated direction indicator.

1,243,529. **Magnetic Brake.** C. Koch, New York, N. Y. Structure of magnetically actuated wheel brake.

1,243,530. **Automatic Lighting System for Doorways.** G. B. Kohler, assignor to Brill Co., Philadelphia, Pa. Circuit controlled by door operating mechanism lights lamp near door or near motorman of railway car.

1,243,539. **Battery Cover Removing Device.** M. Melia, assignor to Commercial Truck Co. of America, Philadelphia, Pa. Structural details of gripping device.

1,243,571. **Electric Controlling System.** H. S. Valentine, assignor to Link-Belt Co., Philadelphia, Pa. Has provision permitting reverse connections of motor when limit switch is open.

1,243,589. **Art or Arc Welding, Heating, and Metal-Working.** C. L. Coffin, assignor to Electric Metal Working Co., Detroit, Mich. Manner of positioning the electrodes and stabilizing the arc by a magnetic field.

1,243,600. **Illuminating Music-Lyre.** G. A. Hambright, Mount Vernon, N. Y. Battery lamp arrangement.

1,243,601. **Railroad-Signal.** J. C. Henley, Fulton, Ky. Structure of track instrument.

1,243,608. **Thermostatic Indicator.** J. M. Johnson, Kansas City, Mo. Details of structure comprising a casing containing a signal and a thermostatically controlled battery circuit.

1,243,628. **Vibrator.** W. van B. Roberts, assignor to R. E. Hopkins, Tarrytown, N. Y. Details of electromagnetic device.

1,243,629. **Surgical Appliance.** E. Roddy, New York, N. Y. Arrangement of belts and circuit connections.

1,243,664. **Concealed Fastening for Wall-Fixtures.** A. J. Weiss, assignor to E. A. McCoy, East Orange, N. J. Structure of lamp bracket securing means.

1,243,665. **Controller for Electric Motors.** G. H. Whittingham, assignor to Monitor Controller Co., Baltimore, Md. Relates to armature resistance control.

1,243,675. **Standard Electric Lamp.** G. T. Irwin, Toronto, Ontario, Canada. Standing structure with provision for adjusting the position of the lamp thereon.

Patents Expired.

The following United States electrical patents expired on October 30, 1917:

660,551. Electric Fan. J. T. Beswick, New York, N. Y.

660,561. Electric Indicator. C. L. Clarke, Rye, N. Y.

660,572. Telephonic Apparatus. R. Gunther, Vienna, Austria-Hungary.

660,613. Process of Amplifying Electric Currents. J. B. Baker, Newton, Mass.

660,620. Non-interference Signal Box. F. W. Cole, Newton, Mass.

660,634. Rotary Snap Electrical Switch. M. Guett, Hartford, Conn.

660,659. Shaped Spool for Drum Armatures. A. Rothert, Riga, Russia.

660,713. Electric Motor. T. S. Watson, Milwaukee, Wis.

660,724. Electric Conveying and Elevator Apparatus. G. K. Fischer, Salt Lake City, Utah, and F. Klepetko, Great Falls, Mont.

660,738. Third Rail for Electric Railways. B. C. Seaton, St. Louis, Mo.

660,779. Fender for Trolley Cars. L. Madas, New York, N. Y.

660,786. Sparking Plug for Explosive Engines. E. T. Birdsall, New Rochelle, N. Y.

660,795. Electric Arc Lamp. C. E. Harthan and G. E. Stevens, Lynn, Mass.

660,803. Measuring Instrument. F. Schrottke, Berlin, Germany.

660,804. Measuring Instrument for Alternating Currents. K. O. F. Schrottke, Berlin, Germany.

660,815. Electric Distribution System. E. M. Hewlett, Schenectady, N. Y.

660,816. Producing High Vacuums. J. W. Howell. Newark, N. J.

660,818. Electric Switch. C. H. North, Cleveland, Ohio.

660,819. Magnetic Signal. C. H. North, Cleveland, Ohio.

660,820. Magneto-electric Generator. C. H. North, Cleveland, Ohio.

660,826. Telephone-call Recorder. H. D. Stroud. Chicago, Ill.

660,836. Electrogalvanic Battery. H. J. Brewer, New York, N. Y.

660,852. Electrode for Arc Lamps. F. Hachmann. St. Paul, Minn.

660,867. Electromagnetic Tooth-stopping Hammer. C. Ostmann, Breslau, Germany.

660,907. Single-phase Alternating-current Generator. B. G. Lamme, Pittsburgh, Pa.

660,908. Variable-speed Electric Motor. B. G. Lamme, Pittsburgh, Pa.

660,910. System of Electrical Distribution. B. G. Lamme, Pittsburgh, Pa.

Financial News and Comment

Bank Loans on Government Bonds.

Seventy-five banks and trust companies of New York City, in a public announcement, pledged themselves to make loans on the 4 per cent Government war bonds at the same rate of interest paid by the Government on such bonds. In the same announcement all banks of the United States were urged to do likewise.

Commonwealth Edison Company.

Samuel Insull has issued the following statement: "There seems to have been unfounded reports that increased costs of coal were influencing the earnings of Commonwealth Edison to such an extent that dividends might be cut down, and some timed stockholders have been influenced to sell their stock. Such is not the case. The Edison Company has its own coal mines and its earnings are so much in excess of increased expenses that stockholders can feel assured there is no likelihood of any changes in dividend rates. The present net earnings are in excess of last year."

Public Utility Dividends.

Texas Power & Light Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable November 1 to stock of record October 20.

Pacific Power & Light Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable November 1 to stock of record October 22.

Columbia Gas & Electric Company declared the regular quarterly dividend of $1 a share, payable November 15 to stock of record October 31.

American Water Works & Electric Company, Inc., declared the regular quarterly dividend of 1¾ per cent on the cumulative first preferred stock, payable November 26 to stock of record November 20.

Bangor Railway & Electric Company has declared a dividend of one-half of 1 per cent on the common stock, payable November 1 to stock of record October 20.

Cities Service Company has declared the regular monthly dividends of ½ of 1 per cent in cash and ½ of 1 per cent in common stock on the common stock, payable January 1 to stock of record December 15. Also two regular monthly dividends of ½ of 1 per cent in cash on the preferred stock, one payable December 1 to stock of record November 15, and one payable January 1 to stock of record December 15. Directors announced that the dividend on the common stock, which will be payable February 1 to stock of record January 15, will be ¾ of 1 per cent, an increase of ¼ of 1 per cent monthly, or at the rate of 9 per cent for the year. This is in accordance with the policy announced in 1916, that in 1918 the common holders would receive 9 per cent in common stock dividends.

Columbus Railway, Power & Light Company has declared the regular quarterly dividends of 1¼ per cent on the common stock and preferred "Series B" stock, payable November 1 to stock of record October 15.

Havana Electric Railway, Light & Power Company declared the regular semi-annual dividend of 3 per cent on both the common and preferred stocks, payable November 15. Books closed October 25 and reopen November 16.

Electric Bond & Share Company declared the regular quarterly dividend of 2 per cent on the common stock, payable October 15 to stock of record October 13; and the regular quarterly dividend of 1½ per cent on the preferred stock, payable November 1 to stock of record October 17.

Lehigh Valley Transit Company declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable November 10 to stock of record October 31.

Illuminating & Power Securities Corporation has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable November 15 to stock of record October 31.

Lowell Electric Light Corporation has declared the regular quarterly dividend of $2.50 a share on the capital stock, payable November 1 to stock of record October 24.

The Board of Directors of the Mobile Electric Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable November 15 to stock of record October 31.

American Utilities Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable November 10 to stock of record October 31.

American Railways Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable November 15 to stock of record November 3.

Reports of Earnings.

REPUBLIC RAILWAY & LIGHT COMPANY.

Consolidated statement of earnings of Republic Railway & Light Company and subsidiaries, inter-company items eliminated, compares as follows:

	1917	1916
September gross	$ 426,250	$ 334,444
Total after tax ...	145,577	150,755
Total income	151,049	151,200
Surplus after charges	63,948	82,177
Balance after preferred dividends ..	37,992	56,220
Twelve months' gross	4,536,528	3,817,024
Net after tax	1,591,594	1,596,783
Total income	1,640,971	1,611,886
Surplus after charges	683,362	820,722

NORTHERN OHIO ELECTRIC CORPORATION.

A balance for the year ended September 30, of $615,772, is reported. The figures for September are:

		Inc. Pct.
Gross earnings	$560,563	23.93
Net earnings	211,502	1.81
Balance after dividends and all charges	60,526	10.95

PHILADELPHIA COMPANY.

Electric Light and Power Department:

	1917	1916
September gross ...	$ 786,539	$ 538,323
Net	217,878	226,843
Six months' gross..	4,299,507	3,165,826
Net	1,229,419	1,390,130

NIAGARA FALLS POWER AND CANADIAN NIAGARA POWER COMPANIES.

	1917	1916
Gross revenue	$845,199	$774,313
Net after taxes	529,494	561,153
Total income	573,594	600,062
Surplus after charges..	324,309	351,127

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid Oct. 23.	Bid Oct. 30.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	..	15	14
Adirondack Electric Power of Glens Falls, preferred	6	55	65
American Gas & Electric of New York, common	10+extra	95	95
American Gas & Electric of New York, preferred	6	42	42
American Light & Traction of New York, common	..	220	210
American Light & Traction of New York, preferred	6	99	99
American Power & Light of New York, common	4	56	49
American Power & Light of New York, preferred	6	75	75
American Public Utilities of Grand Rapids, common	..	24	24
American Public Utilities of Grand Rapids, preferred	6	58	58
American Telephone & Telegraph of New York	..	..	..
American Water Works & Elec. of New York, common	..	4½	4½
American Water Works & Elec. of New York, particip.	7	11	11
American Water Works & Elec. of New York, first preferred	..	62	60
Appalachian Power of Bluefield, common	..	2	2
Appalachian Power of Bluefield, preferred	7	25	25
Cities Service of New York, common	+extra	218	208
Cities Service of New York, preferred	6	77¾	77¾
Commonwealth Edison of Chicago	8	109	108½
Comm. Power, Railway & Light of Jackson, common	4	38	38
Comm. Power, Railway & Light of Jackson, preferred	6	68	68
Federal Light & Traction of New York, common	..	6	7
Federal Light & Traction of New York, preferred	..	..	32
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	2+2 extra	34	33
Middle West Utilities of Chicago, preferred	6	62	55
Northern States Power of Chicago, common	ex div.7	71	68
Northern States Power of Chicago, preferred	ex div.7	92	90
Pacific Gas & Electric of San Francisco, common	5	38	39¼
Pacific Gas & Electric of San Francisco, preferred	6	85½	85½
Public Service of Northern Illinois, Chicago, common	7	83	75
Public Service of Northern Illinois, Chicago, preferred	6	..	90
Republic Railway & Light of Youngstown, common	4	24	25
Republic Railway & Light of Youngstown, preferred	6	63	63
Standard Gas & Electric of Chicago, common	..	6	6
Standard Gas & Electric of Chicago, preferred	6	28	28
Tennessee Railway, Light & Power of Chattanooga, common	..	3	2¾
Tennessee Railway, Light & Power of Chattanooga, preferred	6	18	18
United Light & Railways of Grand Rapids, common	4	33	30
United Light & Railways of Grand Rapids, preferred	6	63	63
Western Power of San Francisco, common	..	10	10
Western Power of San Francisco, preferred	6	47	47
Western Union Telegraph of New York	extra	88	84
Industrials—			
Electric Storage of Philadelphia, common	4	51	52
General Electric of Schenectady	8	68	130
National Carbon of Cleveland, common	8	63	63
National Carbon of Cleveland, preferred	..	130	130
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	42¾	42
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	56	55

*Last sale.